

Call to Battle Stations

POPULAR MECHANICS MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT

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SEE
PAGE 17



TROUBLE COMES "IN A FLOOD" WHEN YOU NEGLECT REPAIRS



GET A PACKARD CERTIFIED RE-WIRING CHECK-UP TODAY



In these times, it's every American's duty to keep his car in good repair. Don't let a neglected electrical system put your car out of action.

Go to a Packard Certified Re-Wiring station, and let a trained mechanic check the wiring and electrical units for minor defects that might lead to serious trouble. It's the best possible protection against starting failure, poor gas mileage, sluggish performance, and costly replacements of electrical units that can be ruined by neglect.

Packard Certified Re-Wiring stations have the proper checking instruments and tools to do the job right. Mechanics are specially trained in electrical service, and all necessary cable replacements are made with Packard cable—used in more than half of all new cars sold. Packard Electric Division, General Motors Corporation, Warren, Ohio.

Packard

REG. U.S. PAT. OFF.
TRADE MARK

"WORKING FOR VICTORY"

Packard manufactures cable for military aircraft, tanks, trucks, tractors, scout cars, barrage balloons, gun turrets and bomb releases.

THE STANDARD WIRING EQUIPMENT OF THE AUTOMOTIVE INDUSTRY



Reykjavik off the port bow!

TONIGHT, somewhere at sea, a man stands on the bridge of a freighter with the life line of a nation in his hands.

He is straining his eyes for sight of one of those islands which are our country's first line of defense. To these islands must be transported huge quantities of munitions and food. And the only answer is ships, ships, and more ships.

How is America meeting this tremendous responsibility? You'll get a fair idea at such great factories as the Westinghouse plant where the machinery to drive many of those supply ships is being built, or at the huge Westinghouse-operated Maritime Commission plant which is now being erected alongside it.

The "know how" that works 24 hours a day

There, in these factories, is a dramatic example of how Westinghouse "know how" is doing a job for National Defense.

What is this "know how"? It is the ability to get things done in the best possible way—learned in building products for the general welfare and now used in building materials for the common defense.

The same skill and ingenuity that are building

those turbines for the merchant fleet, not long ago built more efficient electric refrigerators and washing machines.

At 17 Westinghouse Divisions, and in the plants of more than 300 sub-contractors, our energies are almost exclusively concentrated on the creation of \$400,000,000 worth of defense materials. It's our way of speeding the day when our "know how" will be serving you again—in the home, the farm, and the factory.

Westinghouse

For the Common Defense

Armor-piercing shot
Bomb fuses
Seadrome lighting
equipment for planes

Navy ship turbines and gears
Lighting equipment
Naval Ordnance
Airplane generators

For the General Welfare

Street Lighting
Motors and Controls

Electric Irons
Electric Refrigerators

Generators
Stokers

These lists mention only some of the many thousands of Westinghouse products.

Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa.

Cope, 1942, Westinghouse Electric & Manufacturing Co.





"We're backing them up"

Marching right along with the armed forces of this country are thousands of telephone workers.

They work side by side with the Army and Navy. Wherever the need is communications, you are likely to find telephone men and their trucks and materials.

Day and night the order is for speed and more speed.

They wear no uniforms, these telephone workers, but men in uniform know how much they are putting into the Nation's biggest job. They see it first-hand and they know it is first-rate.

BELL TELEPHONE SYSTEM



"THE TELEPHONE HOUR" IS BROADCAST EVERY MONDAY EVENING OVER THE N.B.C. RED NETWORK

Popular Mechanics Magazine

Registered in U. S. Patent Office and Canada

H. H. WINDSOR, Founder

H. H. WINDSOR, Jr., Editor and Publisher

April, 1942

Vol. 77, No. 4

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Make Your Car Do for the Duration

REMEMBER the first world war? Automobiles two or three years old sold above their original cost. It may happen again. You can't buy a new car today, so you'd better take care of the old one so that it will last for the duration. An important article in the May issue tells you how to do it—what care the bearings require, whether it's economical to retard the spark setting to use low-octane gasoline, how to nurse the tires and battery along for extra miles. City delivery trucks are expected to run a half million miles. Your car probably will, too, if you give it a chance.

"The Marines Have Landed—"

IT MAY be happening today—American bombers and cruisers attacking an island outpost of the enemy, swift "mosquito" boats darting in to clear the shore, transports moving in close to send barges laden with artillery, 13-ton tanks on lighters, and fighting marines on amphibious tractors. Read "The Marines Have Landed," a feature in next month's issue.

Next Month

RANGING thousands of feet over enemy lines a "blitz" photographer of the U. S. Army trips the shutter, and five minutes later his finished print is dropping down to field headquarters. In a Navy hospital three-dimension X-ray pictures are taken with an amazing new film that has depth. Walt Disney technicians "animate" Signal Corps slide films used to teach the new army aerial navigation, gunnery and military traffic control. "They Shoot on Sight," a May feature, tells of the parts cameramen are playing in the war.

Power for America

JUST in time, Grand Coulee has started its flow of power into the armament industries—and it is but one of 96 great new power projects. One third of the nation's vastly expanded aluminum capacity will be located in Washington this year, energized by Columbia river waters. Next month the Colorado section, with its eight pages of color, will be devoted to "More Power for America," the story of man's greatest structure.

Billions in Treasure

THERE are billions in treasure at the bottom of the sea, waiting to be taken. Gold-laden ships of Spanish explorers, pirate ships of the Caribbean, and now the new crop of vessels that go down each day with rich war cargoes. Next month a famed explorer tells of a great post-war industry to be conducted by diving robots that hunt treasure a mile deep in the sea.

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DOING A BIG JOB FOR YOU AND THE NATION



MAKE YOUR CAR LAST LONGER BY USING PYROIL EVERY MILE YOU DRIVE

"Keep 'em rolling!" Moving metal things treated with Pyroil super lubrication run better and last longer. That applies to the automobile you own and value now more than ever!

In plants throughout the nation where Pyroil is used on machinery, machine tools and production equipment, more man hours can be accomplished, less breakdown, greater operation safety. In every automobile the same: better performance; less trouble and repair; protection to moving parts that means longer useful car life.

Let Pyroil help you make your car last longer. Take it to a service station or garage today for a two minute Pyroil treatment. Learn at first hand why car owners the world over "wouldn't drive a mile without Pyroil!" It will cost you only a few cents. Only a few ounces are needed in crankcase and in fuel tank to start you on the road to safer operation and better preservation of your car. Manufactured and Guaranteed by Pyroil Company, W. V. Kidder, Founder, 54 Pyroil Bldg., La Crosse, Wisconsin, U. S. A.

When you put Pyroil in your car it cleans harmful contaminations out of your engine. Then it **KEEPS** them out while safeguarding parts, inducing better performance, and saving on operation costs.



FREE A few moments' reading of Pyroil fact bulletins and literature will be of value to you today in preserving your car for longer useful life. These will be sent to you free and without obligation. Mail coupon below.

DISTRIBUTORS:
CHECK AND MAIL COUPON FOR FRANCHISE FACTS.

PYROIL COMPANY
54 Pyroil Bldg., La Crosse, Wisconsin

Send me Free important fact bulletins and literature that tell me how to preserve the engine of my car.
☐ Send details of plan for Distributors.

Name.....
 Address.....
 City or Town..... State.....

"KEEP 'EM ROLLING!"

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Where no name and address appear directly under an item, the product is not believed by us to be commercially available

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You may worry
about
your taxes



but here is one worry you can avoid

WITH taxes going *up* this year, you'll want other expenses to come *down*! So take *extra* care to avoid *extra* wear on your car's king pins, tie rods, steering crank bearings and other vital friction points that means costly repair bills when neglected! Play safe—with Marfak bumper-to-bumper *chassis lubrication* every 1,000 miles!

Marfak is scientifically applied by *chart*, not by chance. It is *super-tough* . . . contains heavy-bodied oils . . . and resists wear-out, wash-out and squeeze-out!

Do you want your car to "ride like new"? Do you want extra miles of quieter, smoother performance? Then never say "grease-job". Insist on Marfak 40-point lubrication! At Texaco and other good dealers everywhere.



TUNE IN

FRED ALLEN every Sunday night;
METROPOLITAN OPERA every Saturday afternoon. See your local newspaper for time and station.



You're Welcome at **TEXACO DEALERS**



DEFENSE BONDS



Purity...
in the big big bottle
—that's **PEPSI-COLA**

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"No, I Can't
Talk to
You..."



AN UNUSUAL TRUE STORY

**It May Have a Tip
for You**

"No, I can't talk to you. I am not interested in a correspondence course in Accounting and besides, I have a bowling date for tonight."

That's what our representative heard one day two years ago from a bright young man, high school graduate and bookkeeper for two years in a western city. Let's call him Jim, although that isn't his real name.

Just a month or so before, this same LaSalle representative had enrolled for the very same training another young man (let's call him Bert) recently arrived from Europe and then working as an office boy in the same town at \$15 a week. Bert worked enthusiastically, aggressively in his spare time on his study.

A year later our representative was asked, as they so often are, to recommend a successor to the chief accountant of Jim's company, a successor to the man under whom Jim worked. He recommended Bert and Bert was hired—as Jim's boss and at a salary considerably larger than Jim received. Four months later, Bert was made comptroller and given another salary increase.

A month later, Jim enrolled for the training which he had turned down a year before and he has since had a salary raise. He had been badly disappointed but he saw the point. He decided that he would not make the same mistake twice.

An Unusual Story—Yes

It doesn't often happen exactly as it did in this case. But in essence it does happen far more frequently than you suspect.

For business, when it has an opening, looks first to its own present employees to see who is ready and prepared for the job. But if, as so often happens, it finds no one, then it goes outside for the person it wants.

Don't blame the employer. Nine times out of ten, he would prefer a man or woman already experienced and familiar with company policies and methods. But he knows that long, loyal service in the job below may not be enough—he must have trained ability for the position.

That's why business watches its employees so eagerly—to see who is ambitiously and systematically preparing for promotion. We hear it over and over again—this note of gratitude when we tell an employer (as we do on request of any student) that some employee of his is training with us for better service to him.

Can It Happen to YOU?

There's only one way to be certain it cannot. That is to prepare yourself for the jobs ahead—for the place you want, either with your present company or some other. And quick action is particularly important in this critical period with so many changes and opportunities.

Mailing the coupon below can be your first step. It will bring to you—without cost or obligation—a free 48-page booklet about the business field of your choice, telling of the opportunities and requirements and describing our proven and low cost training for success in that field. Why not take that first step now?

LASALLE Extension University a Correspondence Institution Dept. 464-R Chicago, Ill.

I do not want this to happen to me as it did to Jim. Send me your free booklet on the field I have checked below.

- | | |
|-----------------------------------------------|------------------------------------------------|
| <input type="checkbox"/> Higher Accountancy | <input type="checkbox"/> Expert Bookkeeping |
| <input type="checkbox"/> Foremanship | <input type="checkbox"/> Industrial Management |
| <input type="checkbox"/> Executive Management | <input type="checkbox"/> Traffic Management |
| <input type="checkbox"/> Law: L.L.B. Degree | <input type="checkbox"/> Salesmanship |

Name Age

Present Position

Address



U. S. Government Urges Motorists to Protect Beauty Four Times a Year



SIMONIZ SAVES FINISH ON "CAR YOU HAVE"

You will probably be driving your car a long time. To preserve the finish, Simoniz! And do it right away! Simoniz keeps weather, dirt, moisture, and ultra-violet rays from dulling and destroying the lacquer and enamel. That is why Simoniz is necessary to make your car's beauty last through this emergency.

MOTORISTS WISE

SIMONIZ



Sold everywhere by
dealers in automotive
supplies.

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Adjustable dial belt	159
Walker L. Schott Co., 3994 W. Pico Blvd., Los Angeles, Calif.	
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The best I.C.S. ads are written by I.C.S. Students

!

FOR EXAMPLE, here's part of a long letter of appreciation from Mervin L. S. _____ of Harrisburg, Pennsylvania:

"During an excellent secondary education and three years at the University of C. _____, I failed repeatedly in Algebra and Geometry, and it was only by exceptionally good work in theory that I obtained passing grades in Science. I. C. S. presents its subjects in understandable style, with little lost motion and confusion, and with great interest."

Here are some excerpts from other recent letters: "I was 42 years old at the time of enrolment. The Course has paid for itself many times over." (Chas. A. M. _____, Calumet City, Ill.) "My income when I enrolled was \$77 per month. It is now \$340 per month!" (C. E. H. _____, Ravenna, Ohio.)

Somewhere in the I. C. S. curricula is a course that can help you achieve greater success in your line of work. The cost is so low, the rewards so great, you can't afford not to mail this coupon for complete information! No obligation, of course. Do it today—America needs trained men in order to outproduce the enemy!

INTERNATIONAL CORRESPONDENCE SCHOOLS HELPING TO TRAIN AMERICANS FOR VICTORY

BOX 5632-J, SCRANTON, PENNA.

Without cost or obligation, please send me a copy of your booklet, "Who Wins and Why," and full particulars about the course *before* which I have marked X:

TECHNICAL AND INDUSTRIAL COURSES

- | | | | |
|-------------------------------------------------|---------------------------------------------------|---------------------------------------------------|-------------------------------------------------|
| <input type="checkbox"/> Air Brakes | <input type="checkbox"/> Contracting and Building | <input type="checkbox"/> Marine Engines | <input type="checkbox"/> Sanitary Engineering |
| <input type="checkbox"/> Air Conditioning | <input type="checkbox"/> Cotton Manufacturing | <input type="checkbox"/> Mechanical Drafting | <input type="checkbox"/> Ship Work |
| <input type="checkbox"/> Airplane Drafting | <input type="checkbox"/> Diesel Engines | <input type="checkbox"/> Mechanical Engineering | <input type="checkbox"/> Ship Drafting |
| <input type="checkbox"/> Architectural Drafting | <input type="checkbox"/> Electrical Drafting | <input type="checkbox"/> Mine Foreman | <input type="checkbox"/> Shipbuilding |
| <input type="checkbox"/> Architecture | <input type="checkbox"/> Electrical Engineering | <input type="checkbox"/> Navigation | <input type="checkbox"/> Steam Electric |
| <input type="checkbox"/> Auto Engine Tune-up | <input type="checkbox"/> Electric Lighting | <input type="checkbox"/> Patternmaking | <input type="checkbox"/> Steam Engines |
| <input type="checkbox"/> Auto Technology | <input type="checkbox"/> Foundryman | <input type="checkbox"/> Plumbing | <input type="checkbox"/> Steam Fitting |
| <input type="checkbox"/> Aviation | <input type="checkbox"/> Heat Treatment of Metals | <input type="checkbox"/> Practical Telegraphy | <input type="checkbox"/> Structural Drafting |
| <input type="checkbox"/> Aviation Mechanic | <input type="checkbox"/> Highway Engineering | <input type="checkbox"/> Public Works Engineering | <input type="checkbox"/> Structural Engineering |
| <input type="checkbox"/> Balmaking | <input type="checkbox"/> House Planning | <input type="checkbox"/> Tulp and Paper Making | <input type="checkbox"/> Surveying and Mapping |
| <input type="checkbox"/> Bridge Engineering | <input type="checkbox"/> Industrial Metallurgy | <input type="checkbox"/> Radio, General | <input type="checkbox"/> Telegraph Engineering |
| <input type="checkbox"/> Chemistry | <input type="checkbox"/> Locomotive Engineer | <input type="checkbox"/> Radio Operating | <input type="checkbox"/> Telephone Work |
| <input type="checkbox"/> Civil Engineering | <input type="checkbox"/> Machinist | <input type="checkbox"/> Radio Servicing | <input type="checkbox"/> Textile Designing |
| <input type="checkbox"/> Coal Mining | <input type="checkbox"/> Management of Inventions | <input type="checkbox"/> R. R. Section Foreman | <input type="checkbox"/> Toolmaking |
| <input type="checkbox"/> Concrete Engineering | | <input type="checkbox"/> R. R. Signalman | <input type="checkbox"/> Welding |
| | | <input type="checkbox"/> Refrigeration | <input type="checkbox"/> Woolen Manufacturing |

BUSINESS COURSES

- | | | | |
|----------------------------------------------|--------------------------------------------------|--------------------------------------------------|-----------------------------------------------|
| <input type="checkbox"/> Accounting | <input type="checkbox"/> Advertising | <input type="checkbox"/> College Preparatory | <input type="checkbox"/> First Year College |
| <input type="checkbox"/> Bookkeeping | <input type="checkbox"/> Business Correspondence | <input type="checkbox"/> Commercial Illustrating | <input type="checkbox"/> Foremanship |
| <input type="checkbox"/> Business Management | <input type="checkbox"/> Business Mathematics | <input type="checkbox"/> Cost Accounting | <input type="checkbox"/> Good English |
| <input type="checkbox"/> Cartography | <input type="checkbox"/> Civil Service | <input type="checkbox"/> C. I. Accounting | <input type="checkbox"/> High School |
| | | | <input type="checkbox"/> Managing Men at Work |

HOME ECONOMICS COURSES

- | | | |
|-----------------------------------------------|-----------------------------------------------------------------|----------------------------------------------------------------------|
| <input type="checkbox"/> Advanced Dressmaking | <input type="checkbox"/> Home Dressmaking | <input type="checkbox"/> Tea Room and Cafeteria Management, Catering |
| <input type="checkbox"/> Foods and Cookery | <input type="checkbox"/> Professional Dressmaking and Designing | |

Name _____ Age _____ Address _____

City _____ State _____ Present Position _____

Canadian residents send coupon to International Correspondence Schools (London, Limited), Montreal, Canada

British residents send coupon to I. C. S., 71 Kingsway, London, W. C. 2, England



MEN ^{whether you are} 16 or 50

YOU ARE VITALLY NEEDED IN OUR NATIONAL VICTORY PROGRAM



Learn **ELECTRICITY** IN 12 WEEKS

ON REAL MOTORS, GENERATORS, ETC.

Ill Finance Your Training

Trained Electrical men needed now. It's not how young you are, or how old you are. The question is—have you the training to hold a particular job that must be filled.

Electricity offers you the opportunity you have always wanted—if you'll prepare for your place in this field.

Here at Coyne you can train in 12 weeks—not by books or lessons, but on real actual electrical machinery and apparatus. You "Learn by Doing". And you don't need much money. I'll finance your tuition and you can pay it in easy monthly payments after your training period is over. Then if you are short of living expenses we'll get you a part time job to "earn while you learn". After graduation we give you lifetime employment service.

Right now I'm including an extra 4 weeks Radio Course at no extra cost.

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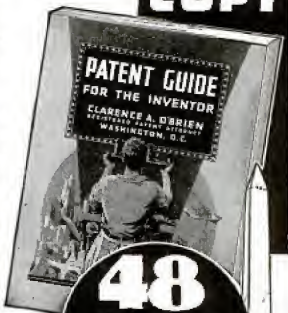
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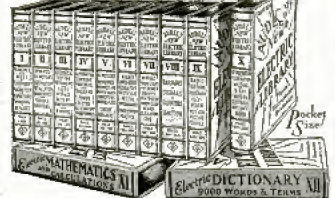
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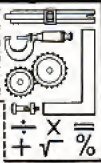
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CANAL Zone—Panama Canal commemorative and Ecuador with U. S. flag in natural colors, also "guano" stamp, Chinese "triangle" stamp, "earthquake" airmail, Mozambique, Morocco, Ex-Naci colony, Guatemala, etc. 5c. 10c. 15c. 20c. 25c. 30c. 35c. 40c. 45c. 50c. 60c. 70c. 80c. 90c. 100c. 110c. 120c. 130c. 140c. 150c. 160c. 170c. 180c. 190c. 200c. 210c. 220c. 230c. 240c. 250c. 260c. 270c. 280c. 290c. 300c. 310c. 320c. 330c. 340c. 350c. 360c. 370c. 380c. 390c. 400c. 410c. 420c. 430c. 440c. 450c. 460c. 470c. 480c. 490c. 500c. 510c. 520c. 530c. 540c. 550c. 560c. 570c. 580c. 590c. 600c. 610c. 620c. 630c. 640c. 650c. 660c. 670c. 680c. 690c. 700c. 710c. 720c. 730c. 740c. 750c. 760c. 770c. 780c. 790c. 800c. 810c. 820c. 830c. 840c. 850c. 860c. 870c. 880c. 890c. 900c. 910c. 920c. 930c. 940c. 950c. 960c. 970c. 980c. 990c. 1000c. 1010c. 1020c. 1030c. 1040c. 1050c. 1060c. 1070c. 1080c. 1090c. 1100c. 1110c. 1120c. 1130c. 1140c. 1150c. 1160c. 1170c. 1180c. 1190c. 1200c. 1210c. 1220c. 1230c. 1240c. 1250c. 1260c. 1270c. 1280c. 1290c. 1300c. 1310c. 1320c. 1330c. 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YOUR Choice: 16 regular size prints or 8 double-size prints (nearly past card size) from 8 exposure roll or negative—25c. 24 hour service. Satisfaction guaranteed. Willard Studios, Box 3535 A, Cleveland, Ohio.

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MODELS, Experimental work, tools, special machinery, designing, manufacturing. Inventions commercialized. Industrial Tool Service, Box 41, Rochelle Park, N. J.

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1000 TELL How Plans tell homeowners about building 1000 projects. List 10c. C. King, E. Kingston, N. H.

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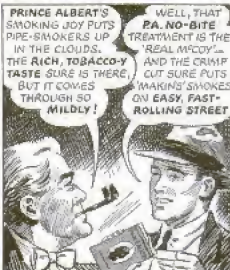
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Popular Mechanics Magazine

REGISTERED IN U. S. PATENT OFFICE AND CANADA

WRITTEN SO YOU CAN UNDERSTAND IT

Vol. 77

APRIL, 1942

No. 4

SCIENCE LOOKS AHEAD



Three-dimensional plastic models built on scale of 500 candlepower to the inch demonstrate light distribution from luminaries of today's street lamps (left) compared with the best street light of 25 years ago

UKNOWN realms of science are being explored so successfully that researchers are getting glimpses of new wonders likely to be of infinite benefit to mankind.

All civilization may take a tremendous forward step when radiations almost as powerful as the mysterious cosmic rays emanating from the sun are placed at the disposal of the physicist. And that time is not far away. Work has started on a machine that will whirl electrons up to an energy of 100,000,000 volts, regarded by scientists as approaching the cosmic ray.

Strange plants may result from the bom-

bardment of fruit trees, berry bushes and vegetable seed with 1,000,000-volt X-rays. Alteration of chromosomes in living cells of fruits and vegetables, producing changes in color, size, flavor, quality, resistance to disease and other characteristics, is the objective of this effort.

Because heavy metal wheels are being spun 1,000 times per second in a vacuum bottle, air transports of the future may operate at altitudes far above those commonly used today, and at much higher speed because air drag is less at the upper levels. The metal wheels are spun in a ma-

APRIL, 1942

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21408

March Benford



Using a spotlight to simulate the sun, technician studies seasonal variations in amount of sunlight striking walls of model house on globe. Shadow picture (right) shows cold stream descending from ice cube in water

March 1942

chine employed in testing rotors of turbo-superchargers, which make possible efficient operation of airplane engines in thin air. In use, the rotors turn at a speed where centrifugal force will make a pound weight on the periphery exert a pull of more than 50 tons. The engineer, seeking to design rotors that will not fly apart under the enormous stresses normally created, or larger ones accidentally applied, makes use of a test machine in which a pound mass

exerts a centrifugal pull of over 100 tons. As the metal wheels approach a speed of 1,000 revolutions per second, they literally explode, giving their fragments as much energy as a projectile fired from a small naval gun. Tests are conducted in a vacuum chamber so air resistance will not impede the wheels at extreme speeds.

Some molecules wriggle like worms when an alternating current is applied to them, it has been found in the General

Making glass gloveless by coating it with thin film of magnesium fluoride vapor under high-vacuum globe in General Electric laboratory



see Jan. 1942. 81

Electric Research Laboratory. The force required to make them wriggle gives scientists important information regarding their weight and structure. Then, knowing how they are built, new molecules can be designed, with properties to meet specific needs. The importance of this study is found in the fact that these wormlike molecules have many useful applications; artificial silk and rubber are made of them, also many plastics.

Not too far in the future are false teeth, so constructed that permanent magnets in upper and lower dentures repel each other. This repelling

I 1400

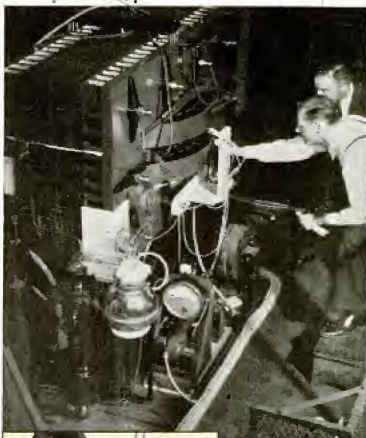
Mr. Donald W. Kiser

Mr. E. Charlton

action forces the dentures against the gums, eliminating the need for adhesives to make the teeth stay in place. Magnetic teeth are made possible by Alnico V, an alloy with about three times the energy of any previously known permanent-magnet material.

Shortages of metals have sent the scientist in search of alternate materials. In the field of heat-resisting alloys, study is being made of compositions requiring a minimum of nickel, one of the strategic metals. Already new alloys of aluminum, copper and zinc have been developed.

Fighting pilots must be kept warm in high altitudes. As a result of research aimed at development of electrically heated flying suits for America's aviators, all of us may wear heated clothing a few years hence. Instead of heavy underwear, thick wool suits and huge overcoats, we may don a single lightweight garment that will keep us warm in the coldest weather. This suit would be wired throughout and plugged in on current from a small battery, the electrical system of the automobile or the lighting circuit of home or office. Already many pilots of our war planes are wearing electrically heated suits designed to keep them comfortable in temperature ranging from 60 degrees below zero to 70 degrees above. These flying suits are many pounds lighter than the sheep-



This is the 20-million volt "cosmic-ray generator"; now G. E. is building a similar one of 100 million volts

Electrons are accelerated in "doughnut" glass vacuum tube to highest speed yet achieved by engineers

A research scientist studies the faults in glass under beam of light from a high-intensity mercury lamp



Mr. N. J. Leonard

21400
 S. E. Laboratories at
 Schenectady
 March 1924
 Dr. E. B. Rutherford
 and Dr. E. C. Rutherford



Young apple trees, above, were bombarded with million-volt X-rays to attempt changes in heredity. Below, measuring reflecting power of different metals



skin-lined garments which they replaced.

Fully as important to the aviator are the laboratory studies which resulted recently in a new means of measuring the height of clouds from the ground in the daytime. Maurice K. Laufer and Laurence K. Fosskett of the National Bureau of Standards found that by projecting the light from a tiny, 1,000-watt mercury lamp and noting with a photo-electric cell—"electric eye"—the "splatter" of light where it hit a cloud, the altitude could be calculated by triangulation. The projector consists of the lamp located at the focus of a 24-inch parabolic mirror having a 10-inch focal length. The

narrow beam is projected into the sky at a frequency of 120 flashes per second and the rays scatter when they hit the clouds. The light scattering is detected by the electric eye located at a known distance from the lamp and adjusted for this flash frequency to distinguish the beam from background atmospheric light. The cloud height then is determined by the solution of the right triangle formed by the line of the beam to the clouds, the angle of the electric eye sight upon the clouds and the base line connecting the beam projector and the photo tube.

How much sunlight falls on the south side of your house in a year? You probably don't know, perhaps don't care, but it's an important subject of research in the General Electric laboratory. Out of these studies may come recommendations for building homes so that the maximum amount of sunlight may be utilized, or radically different means of heating evolved. One scientist working on the problem employs a house-shaped model attached to a globe. If the model were in proportion to the size of the earth, it would be 1,400 miles high. This model, as well as the globe, is illuminated by a spotlight, which simulates the sun, mounted across the room. This apparatus helps to check calculations of the amount of sunlight which falls on various walls of a building, oriented in different directions, and at different times of the year.

Most of us have been annoyed by glare

(Continued to page 185)

Electrically heated flying suit for Air Force is tested at 63 degrees below zero at Ft. Monmouth



*M 39. Alton London Electrotype Agency Ltd
134 Fleet St London E.C.4*

"Halifax" Bomber Carries an Enormous Load

Biggest and fastest plane built by the British aeronautical firm of Handley-Page, Ltd., is the "Halifax" bomber, which has been playing an important part in the Royal Air Force long-range attacks on Germany, Italy and occupied France. Its bomb compartment takes up most of the space in the fuselage below the wings, and through vast doors in the floor the bomb aimer releases the heaviest type of bombs in production. The "Halifax" is the first British four-engine plane in some years to be equipped with liquid-cooled motors. These are Rolls-Royce "Merlins."

Heavily armed for its own defense, the plane has a four-gun "Boulton-Paul" turret mounted behind its twin tail fins and rudders. Seven men form the crew.



↑
Pilot (top) of a Halifax bomber awaits the signal to take off; behind him is the second pilot, below, the radio operator

←
The ground crew loading bombs into the fuselage is dwarfed by immense craft, one of most formidable long-range bombers

M 111

"Vegetable Ivory" Seen as Wartime Source of Material for Buttons

Because of a shortage in materials from which buttons are usually made, including plastics, the United States Army has ordered 2,592,000 "vegetable ivory" buttons, made from tagua nuts produced in Ecuador. Tests of the tagua nut buttons proved

the hard material withstands pressure and heat without cracking and remains color-fast after numerous washings and long exposure to intense artificial sunlight. They may be used on all soldiers' garments except where metal buttons are required.

S O S Buoy Floating on the Sea Sends Signal 60 Hours



Cast into the sea from a lifeboat, this buoy stays afloat for 60 hours sending S O S signals. Note seaman's hood and cloak

To aid in the rescue of seamen adrift at sea, a buoy developed in England flashes S O S signals continually for 60 hours while floating on the surface. A new hood and cloak issued to the men guard them against exposure while awaiting rescuers.

Cakes Can Be Made Fluffier By Delaying Rising

Biscuits and cakes will turn out larger and lighter when baking powders and self-rising flours are treated with a new phosphate complex, declares Dr. Howard Adler, chief chemist of the Victor Chemical Works in Chicago. The chemical, known as hydrated monocalcium phosphate, is applied as an extremely thin coating on a compound used as the acid constituent of baking powder and flour. Ordinarily the baking acid reacts with the bicarbonate of soda so rapidly that much of the carbon dioxide

gas escapes before the dough has reached the point where it can retain the gas. With the coated product, however, liberation of the gas is retarded until water has penetrated the insoluble coating, making it possible for the dough to retain a much larger percentage of the gas. This action results in baked products of larger volume that are lighter and fluffier.

Fabric Is Made Flameproof By Dip in Chemical

Airplane fabrics, party dresses, welders' overalls, blackout curtains and draperies—all these can be made flameproof by dipping them into a chemical solution that until recently was a costly laboratory curiosity but now is in economical production at a new Du Pont plant. The chemical is ammonium sulfamate. Sprayed with this solution or dipped in it, a fabric may char on contact with fire, but will not flame nor support combustion. One pound of the chemical is used in a gallon of water. Fabrics immersed in it and then dried will be flameproof until washed, when the treatment can be repeated; dry cleaning, however, does not appreciably impair



This candle test proves that fabric treated with ammonium sulfamate may char, but it will not flame

the fireproofing. The appearance and "feel" of material is not affected by the ammonium sulfamate. The treatment is already being used in war industries where there is a fire hazard, and also by some dry cleaners.

Stand Turns Engine To Aid Repairman In Reaching Parts

Faster repair of airplane engines is made possible by mounting them on a rotating stand that saves time for the serviceman in reaching any desired part. By turning a crank the engine can be rotated completely and it remains in any position without being locked. Engines are prevented from turning over accidentally by a unique mounting arrangement which permits adjustment of the frame to maintain the center of balance on types of engines that vary in weight.



Rotating stand makes all parts of engine quickly accessible for repairs

Helicopter Ferry Is Foreseen As Latest Craft Passes Test



Its multiple rotors spinning, the newest of the Sikorsky line of helicopters hovers motionless at treetop level on one of its trial flights

Helicopters will ferry the city dweller from his home to his office or airport, and giants of this rotary-wing breed will taxi air passengers between metropolitan airports and downtown sections in the postwar years if the predictions of Igor Sikorsky are fulfilled. The famous aeronautical designer, testing his latest one-man helicopter recently, approved its performance after taking the craft up vertically, hovering motionless in midair and making a good landing

after various maneuvers. The newest helicopter has a fabric-covered cockpit and partly enclosed fuselage. Mr. Sikorsky said this type of aircraft could not develop the high speed necessary for long-distance transportation but would find a definite place in ferry service after the war.

(Names and addresses of makers or sellers of commercial products described in this magazine are listed in the Where-to-Buy-It index. Write to them for additional information and be sure to Say You Saw It in Popular Mechanics.

21401

Cmt. Thomas E. Stinson Jr
3872 Franklin Ave
Los Angeles



This is the new type of butt action gun, shorter than the standard design. Notice the cocking lever on the butt near shoulder

SUPER SPEED BULLETS KNOCK 'EM DEAD

MAKING elaborate calculations for range and wind, a rifleman aimed at a target of armor steel. His heavy slug went halfway through the metal and raised a bulge on the other side.

Another marksman put a small club-shaped weapon to his shoulder and without bothering to correct for the range fired into the same steel slab. His bullet went all the way through, exploding and expanding as it pierced the metal.

The remarkable thing about this was that the first rifleman was shooting a standard 30.06 army gun, while the second was using a small .22-caliber rifle.

It was an unusual 22,

Left, .22-caliber magnum cartridge which pierced steel plate; center, standard .22 long rifle cartridge; right, 30.06 army cartridge. Regular army ammunition only dented the steel plate



to be sure. The ordinary .22 will hardly knock down anything bigger than a rabbit, yet the new one is a big-game rifle and has been used in every part of the world against all sorts of game. As far as is known every animal hit by it has dropped dead in its tracks. Even when hit in the lower part of a leg an animal dies at once. There is no record that it has ever merely crippled or wounded.

This sounds something like the futuristic ray gun of the comic strips, and in a way that is what the lit-



↑
Weighing out the big powder charge for hand-loading super-high velocity .22 magnum cartridge

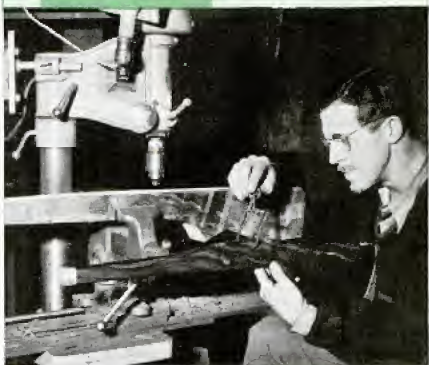


← Automatic rifle redesigned for super-bullet results in flatter trajectory and greater killing power

↓
Taking measurements from finished butt-action gun stock before starting to shape blank in vise

tle rifle is. It has added an entirely new principle to the science of ballistics. The tiny .22 pellet, weighing about one tenth of an ounce, travels at super-high velocity. It kills by hydrostatic shock. It has the same effective range as an army rifle but has a drop of only $4\frac{1}{4}$ inches at 400 yards as compared to the four-foot drop of service ammunition. It explodes on contact even with a twig, yet it is armor-piercing.

Super-high velocity is one of the contributions that "wildcat" gunsmiths



21401



Star Route, Topanga Canyon

Sighting the telescope finder of the .22 magnum rifle

Here you can compare the length of the new short butt-action carbine with longer conventional rifle



are making to their art, and it is having an effect on sporting and military guns. These "wildcats," the independent gun makers who build fine guns to special order and who charge you \$200 to \$600 for one, have been experimenting with super-high velocity for years. One of these is Ralph Waldo Miller. At his ranch at the end of a dirt trail off Topanga Canyon near Los Angeles he will build you a Miller Magnum .22-caliber rifle that will give you a triple advantage in a duel with, say a German or a Jap soldier armed with one of their best military shoulder weapons. At any ordinary distance you could point your gun directly at your victim, while he has to guess your range and elevate his sights. When you pull your trigger you get a light tap on the shoulder.

Super-high velocity research applied to this 37-mm. antitank gun would give it efficiency of 75mm. gun

When your opponent fires the recoil batters his shoulder bone and unsteadies his aim. If he hits you the wound may not be serious, but when your first bullet strikes him the fight is over.



The terrific speed of the bullet does the trick. The pellet gets its tremendous velocity from an oversize powder charge that would blow the gun to pieces if it were not for the careful shaping of the cartridge which has been designed to direct the

(Continued to page 189)

*M 22. Cmt. Thomas E. Simpson, Jr.
3842 Franklin Ave
Los Angeles, Calif*

Engine Exceeds One Horsepower Per Pound

Opposed-barrel engine of 90 horsepower weighs → only 78 pounds without propeller, stand and tank

Rigid connecting rod between pistons delivers power to inclined plane on parallel crankshaft
↓



tal model, a larger engine was built with a dry weight of 78 pounds which delivered more than 90 horsepower at 3,000 revolutions per minute. It is an 8-cylinder opposed "barrel" type, each pair of opposed pistons being connected by a rigid connecting rod. An offset bearing on this rod delivers the power to a sort of inclined plane or worm gear on the crankshaft, which is parallel to the connecting rods. The engine is of the two-cycle type, and to a certain

More than one horsepower per pound of engine weight, a goal engineers have been seeking for airplane motors, is claimed for a new engine of radical design invented by Alvin R. Earnshaw of California. After successfully operating a small experimen-

extent each cylinder acts as its own supercharger: the fuel charge is compressed on each downstroke before it is bypassed into the combustion chamber. About 1½ horsepower is obtained from each cubic inch of displacement.

Flash Illumines Four-Mile Area for Aerial Photograph

Night pictures can be taken from an airplane over a four-mile area in one shot with a brilliant flashlight developed by Floyd Brown of Lansing, Mich. The flash produces 4,500,000 to 10,000,000 lumens, depending upon the chemical and gas mixture, which is variable. Such a flash would outshine 200,000 50-watt lamps. The flash-creating mixture is housed in a glass tube with a shatterproof coating.



This tube creates flash lighting a four-mile area

*From Color News Photo
Box 55, Lansing, Mich*

*Ref: Crosby Research Foundation, Pasadena, Calif
880 California St.*

M. 8.
Designed by George W. Wagner,
Section Chief,
New Century Radio,
Mobile Traffic Light on Wheels
Operated by Storage Battery



P. H. Pearson
Six-volt storage battery operates this portable traffic light

Intended for use at schools and factories where there is only occasional traffic congestion, a portable automatic traffic signal can be wheeled into the street when needed. It is operated by a storage battery.

M. 72
Pilots Lost at Sea Rig Up Radio
To Call Aid, Find Position

newspaper clip
Ingenious work by radiomen and the use of weather and sun information to plot their position saved seven navy men adrift eight days in a flying boat disabled while patrolling the waters off the Panama Canal. Navigating instruments were lost or wrecked when they were forced down on the rough sea. One compartment was flooded and had to be closed off by watertight doors, and two men had to bail the

fore and aft compartments continually to keep the plane afloat. After five and one-half days of work the two radiomen succeeded in rigging up a transmitter and generator from broken parts, and their call for help was quickly heard by a Federal Communications Commission monitor in Pennsylvania. Soon after they contacted the Panama Canal station, but they could not give their location. A day before they were found, a rescue ship asked for weather conditions around the plane. The ship then proceeded to the area where such conditions were expected to prevail. Then the ship asked the plane to report the exact time of the next sunrise, and, by comparing it with sunrise time on the ship, the plane's position was estimated closely, and the men spotted that afternoon.

M. 21
Rubberized Lifesaving Suit
Keeps Man Dry, Warm

Lifesaving overalls that not only keep a man afloat but warm and dry were introduced recently, and Capt. Erling Vorberg, skipper of a torpedoed Norwegian tanker, testifies these suits saved many lives on his ship. The suit is of rubberized twill, with a kapok jacket and



This overall keeps man afloat and warm for hours

m 30

heavy boots attached. It can be donned in a minute. Members of Captain Vorberg's crew were pulled from the water still warm and dry despite two hours' immersion, and the captain reported that his boatswain was rescued although floating unconscious, kept upright by the heavy boots in his overalls.

Outrigger Wheels Stabilize Truck During Test

In testing front axle steering knuckles and king pins, also front and rear wheels, trucks are driven at high speed over a short figure eight course on the rough surface at International Harvester company's proving ground in Fort Wayne, Ind. If left to their own devices, the trucks would take the turns on two wheels and turn over. Upsetting is averted by equipping the truck with an outrigger having auxiliary wheels so located that they keep all four wheels of the truck on the ground, yet do not interfere with the purposes of the test.



Outrigger keeps truck from tipping over on sharp turns like this one

Homemade Plane-Spotting 'Ear' Built of Low-Cost Parts



Planes 10 miles away can be spotted with horn and amplifier hookup

Showing how easy it is to build a "tin ear" to spot the approach of air raiders, Dr. Donald A. Wilbur of Rensselaer Polytechnic Institute, Troy, N. Y., hastily assembled a simple instrument from low-cost parts. It would be possible to construct similar locators for local air-raid spotters throughout the country without great expense. The detector, made up of a few boards, a large tin horn from an old phonograph, a microphone, a battery-operated amplifier and a pair of ear phones, is capable of picking up the sound of bombers five to ten miles distant.

80 N. Michigan Ave
Chicago

WINGS *for* FREIGHT

By M. T. Stallter

Manager Air Mail and Air Express,
American Airlines, Inc.

Municipal Airpark
WHETHER it's a live chin-chilla from South America you want, a fresh-caught 200-pound turtle from the Galapagos or a ton of precious seed from a nursery 3,000 miles away, you can have it tomorrow by air freight.

You won't believe until you see it? Well, you won't have to wait long. Air power is revolutionizing the world, militarily, politically, and economically. Tomorrow, man will fly the bulk of his important cargos and think nothing of it.

The B-19, the Army's giant bomber, has passed its tests. Gross weight of the B-19, the world's largest plane, is 70 tons, or 140,000 pounds; its useful load, 28 tons. This huge aircraft can fly 7,000 miles nonstop, the



American Air Line
Although designed primarily to carry passengers, the modern air liner has large capacity for mail and express, being loaded above

JWA
Stripped of furnishings, interior of big air liner indicates cargo possible in future freight planes





distance of a round trip between New York and Paris. Planes somewhat like it will be the aerial freight cars of tomorrow. With its tremendous range it brings Europe and South America within a few hours of New York or Chicago. The Army Air Freight System flies cargo on regular schedule between Air Force units throughout the nation and the Panama Canal.

But what of commercial air cargo services in the United States today and tomorrow? Several plans have been tried; none has succeeded as Americans would have them succeed. Why? Because the airplanes used would not operate economically enough to get the volume necessary for reasonable return. The railroads do not use a modified passenger car for freight. They use equipment designed for cargo. That is what the air industry must do. The planes now carrying passengers, mail and express, were designed

(Continued to page 173)

Upper left, United Air Lines cargo handler tightens the stout web straps sealing the new cargo containers. At right, one of the first shipments of live animals carried by a plane



This manikin didn't need a seat—it traveled by air express from New York to Chicago

Into the wide cargo door of an army transport plane, left, goes a set of wings for a new Piper "grasshopper" observation plane

m28

Cigarette-and-Coin Game Tests Smokers' Skill



Strip shows start to near-finish of game. Smokers take turns at burning paper with their cigarettes.

Steadiness and deftness with a cigarette are required in winning a novel coin game. A quarter is placed in the center of a paper napkin clamped with a rubber band over the mouth of a glass. Participants in the game take turns at burning holes in the paper with their cigarettes, the object of the game being to avoid causing the quarter to tumble into the glass. It requires skillful handling of the cigarette, the end of which is usually burned to a sharp coal so it will burn daintily. One favorite trick

1 Holophane Co. Inc.
342 Madison Ave

is to spread a bit of ash on the paper in the direction in which the burn should travel. The loser is the unlucky one who is unable to burn a section of the paper without letting the coin fall. *heigh!*

m25

Street Lamp for Use in Blackout Gives Light Faint as Stars

Emitting no more light than that from stars on a clear night, a blackout street lamp developed in this country is said to meet specifications approved for use in Britain. Spaced 100 feet apart and mounted at a 20-foot height, the lamps provide sufficient illumination for safe movement on the ground, yet they are not bright enough to reveal the identification of important buildings or plants to enemy planes.



2136P

Self-Aligning Strips of Shingles Produce a Random Pattern

Beautiful effects of a custom-built roof are said to be achieved with self-aligning "Random-Tab" strip shingles which make it virtually impossible to repeat the same pattern on different roofs. The shingles are designed to align themselves, the tabs of one interlocking with the notches of another. They also automatically cover all nails and protect the joints. Available in four colors, the new roof covering has wood-grain textures accentuated by deep-cut shadow lines.



Tabs and notches guide roofer in aligning shingles which cover all nails and always form a new pattern.

United States Supreme Court
Chicago

21248

Call to "Battle Stations!"

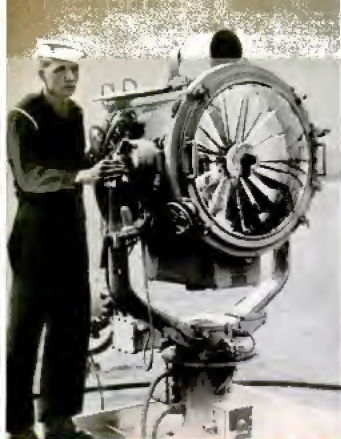


17 Official U. S. Navy photo

Leggett

north Caroline

Hurling gigantic projectiles many miles over the sea, a mighty United States battleship thunders defiance at the enemy. Here we see three big 16-inch guns firing over the bow. Battleships of this type carry nine 16-inch guns, in addition to numerous anti-aircraft and secondary broadside guns



2/4 28
↑
One of Uncle Sam's sailors operates the big searchlight aboard a fighting ship, making easier the spotting of enemy surface and aircraft at night



↑
And here a heavy fighting ship plows through rough seas, carrying out her mission of guarding the United States from enemies

18.
↑
Every man at his post—that's the significance of this view of the navigating bridge aboard an American battleship. Officers on duty are backed by blue-jackets at their stations



Pennsylvania



21228

There's work aplenty for everyone aboard a fighting ship. Above, cleaning 14-inch guns aboard one of the U. S. warcraft. Below, painting the side of an American aircraft carrier. Before the start of the war with Japan, and later with Germany and Italy, the United States had 17 battleships in service and 17 others in various stages of building, from blueprint planning to virtual readiness. The American Navy also included, at that time, six aircraft carriers, 37 cruisers, 170 destroyers, 110 submarines and hundreds of auxiliary vessels already in service and approximately double that number building in scores of shipyards on an around-the-clock basis.



This is the means of communicating between the fighting craft of the navy, particularly for short distances and for periods when radio is shut down and ships are close enough to see the signal flags



Copyrighted material



Official U. S. Navy photo

An exciting moment aboard a huge U. S. battleship—the call to battle stations. The men in the foreground are bending over to batten down the hatch as is always done in sea engagements, while other men are running to their posts. This scene is pictured on the after deck beneath the No. 3 turret. The sleek 16-inch guns towering at an angle toward the horizon are in readiness to be fired at enemy craft

While others attend to the operation of gigantic 16-inch guns, these members of a machine-gun crew practice aboard ship—perhaps to repel small craft or to aid in attempted landings. Proficiency in the use of many types of weapons is taught modern sailors, but particular emphasis is being placed on anti-aircraft guns because of the bombing plane's challenge to the great floating fortresses



Checking the anchor board is just a routine duty, but is one of thousands of jobs aboard our fighting ships that must be performed without error. Some of the latest battleships in the American Navy carry 1,800 officers and men





21 1
This is an excellent view of a big U. S. warcraft. Note the two scout planes that can be catapulted into the air to search out enemy ships and to act as "eyes" of the battleship during an engagement. Modern warfare calls for the closest coordination of ship and plane efforts, not only to surprise the enemy but also to avoid surprise attacks.

Blasting away at an imaginary enemy, this battleship is a mighty unit in America's sea power. Newer capital ships are driven by turbines developing more than 100,000 horsepower. Speed exceeds 25 knots. A vessel of this type carries vast quantities of food, 100,000 gallons of fresh water and makes use of several thousand items essential to a community of 1,800





29
This is the crew of an American aircraft carrier—mother ship to several dozen fighting and bombing planes that already have proved their value in the war against Japan. Recognition of the worth of airmen to the navy is found in the building program that calls for construction of 14 more carriers—some of which are near completion



21228
At left is an impressive scene aboard a United States Navy aircraft carrier somewhere on the Pacific. This photograph shows the vessel's flight deck thronged with planes whose engines are being warmed up for the takeoff. In the group are fighter, scout, bomber and deadly torpedo planes. Flown by highly trained navy pilots, these planes form a powerful weapon. The modern mother ship to battle planes is equipped with a broad deck on which the aircraft take off and land, the latter operation being made possible, in part, by arrester devices that slow the plane's speed when its wheels touch the deck. The ship also has facilities for storing planes below the deck, for servicing and repairing the planes and for housing the pilots and maintenance crews. Takeoffs and landings are accomplished with the aid of an elaborate signal system, consisting for the most part of manual instructions to pilots. While the flight deck looks large, it is a small spot for incoming planes to hit and pilots must obey every instruction for landing at the exact moment intended—or find themselves missing the landing area and crashing into the sea. U. S. Navy pilots are trained so carefully that many authorities consider them the best trained airmen in the world. Dive bombing was originated by American fleet fliers

21228



↑
The signal gun, another means of communication in the navy, is shown in use here aboard a fighting ship

23



↑
This view of an American battleship is remarkable for the unusual clarity of detail. (Photo by Elizabeth R. Hibbs from European Picture Service)

And now for real business—passing shells to the loader for three antiaircraft guns aboard a battleship. Fast work is highly essential here →





1228

Official U. S. Navy photo

24



Photograph above was made from a plane which had just left the flight deck of a United States Navy aircraft carrier in the Pacific. It gives you a bow-on view of the floating air-drome, home of several hundred officers and men and an unrevealed number of fighting and bombing planes, including the most highly developed torpedo planes. Of particular interest to the landlubber is the fact that all structure above deck is at one side, clearing the way for planes to take off and land. Photo at left shows action at the flag bag. Aboard a mighty American battleship at sea, signalmen are seen hoisting and stowing flags in the bag, which is arranged so that signals may be flashed aloft without delay. Also in the picture is a giant searchlight

m 29

Air-Raid and Rescue Truck Guards Building

Equipped to combat fires and rescue people trapped by the effects of bombing, a hand-pushed truck has been assigned the task of patrolling 93 acres of floor space in the Merchandise Mart building at Chicago. Manned by a trained crew, the truck may be placed aboard an elevator and lifted to the floor where it is needed. Its equipment includes spotlights, fire extinguishers, axes, pinch bars, respirators and first-aid materials.



Truck equipped to combat air-raids is rolled into elevator

m 24

"Tiny" Wrench Three Feet Long Replaces 15-Foot Size

Although they may look like giants, wrenches three feet long are really mid-gets compared with the 15-foot wrenches

they replace. The tools are used for turning large nuts on marine steam and Diesel engines. Five men sometimes were needed to obtain the necessary leverage with a 15-foot wrench, and in some instances its length and weight made it too cumbersome for the limited working space aboard ship. Now, with the development of a special alloy, wrenches about one-fifth the former length are being used successfully, and one man can handle them by sledging the tool to turn the nut. Wrenches are available with openings from two to 12 inches.

Separator to Clean Airplane's Oil Is Attached to Engine

Oil in an airplane engine can be cleaned with a centrifugal separator in which impurities are removed as cream is separated from milk. The invention is described in a patent issued to Alan E. Flowers of Poughkeepsie, N. Y., and assigned to the De Laval Separator Company, 165 Broadway, New York City. Hooked up in the circulating system of an airplane, the separator receives oil as it comes from the engine and whirls off the impurities, including carbon and gum. The cleaned oil then returns to the tank and is circulated again through the engine.



These wrenches replace others five times as long

APRIL, 1942

Quarantine Tool Co.

Quarantine Tool Co.

Resurrection. 50 Rochester Plaza New York

m 70

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De Laval Separator Co. 165 Broadway New York

NY Times Jan. 1942

Busy Little Men Do Big Job in Close Quarters



Riveter is aided by a small-size workman who backs up rivets inside a wing frame

Another little man, four-feet two-inches tall, works within wing of a flying boat



Men of small stature are filling important places in the task of speeding the production of warplanes at the Brewster Aeronautical corporation's plant in Newark, N. J. Capable of crawling about in cramped spaces, where normal-sized men cannot enter without great difficulty, these little fellows, less than five feet tall, work freely and efficiently within airplane wings at such jobs as backing up the rivets hammered from the outside by full-sized men, as well as other interior work that must be completed after the wing structure has been assembled.

Trailer Straddles Farm Tools to Carry Them on Highway

Heavy disk plows and other farm equipment barred from paved highways are

moved on the road at truck speed by a trailer that straddles the implement and picks it up. The carrier is a two-wheel cart with rubber tires, short axles supporting fenders on which a triangular steel frame rests. Across the top is a drum made of pipe for winding four chains which raise the implement. This is done by applying a crank to the shaft of an auto transmission connected by a chain to the gear box at



Rubber-tired trailer picks up heavy implement to move it on highway

m 44.

the top of the frame, which in turn is connected by chain with a 10-inch sprocket wheel on the winding drum. A light hydraulic jack holds up the tongue when the carrier is detached from the truck.

Gummed Wallpaper for Borders Is Moistened for Application

Life-Size Manikins Cut From Paper For Display

A favorite art among Polish peasant folk—cutting out small paper figures for Christmas tree ornaments—has grown into the scissors-sculpture of life-size and larger figures under the talented hands of Erica Hanka Gorecka, an American artist. The eye-catching novelty of her creations struck the imagination of a department store display man, who saw the possibilities of using them in window displays. Now samples of Miss Gorecka's art are seen in the form of full-size manikins in several Fifth Avenue windows.



Border is dipped in pan of water, circle, then stuck to molding or wall

Meyersdorf Co., 5323 W. Lake Chicago



Left, building up figure on wood frame; right, two finished manikins

Narrow strips of border wallpaper now available are pre-gummed so the user need not apply paste in hanging them. Immersion in a pan of water makes the strips sticky enough to adhere to old wallpaper, painted walls, hard tile and glass surfaces, and wallboards. Care must be taken with calcimined walls to avoid surplus water which might cause streaks.

¶To learn where to buy commercial products described in these pages, see the index.

21235

Carl Thomas & Lipson Jr
3872 Franklin Ave
Los Angeles



Fire guard riding a scooter patrols an airport, watching airplanes and inspecting hangars for fire hazards

Patrol car covers a "beat" along the 238-mile aqueduct that supplies Los Angeles and neighbor cities with water



IN THE last half of 1941, \$15,000,000 worth of rubber was destroyed in a Massachusetts fire, a million dollars worth of food burned in Boston, and a \$2,250,000 fire halted production of airplane castings in Cleveland. Elsewhere, war machine factories burned to the ground, railroad wrecks occurred and power systems failed. Forests and grain fields burst into flame.

Unfortunate accidents? Not all of them. Incendiarists and wreckers are busy trying to sap our strength. Enemy agents are loose in the United States.

"The time has come for everyone to be on guard," states Chief Lydell Peck, fire marshal of California. "Saboteurs don't necessarily confine their activities to plants engaged in defense work. Anything they can do to slow us down tends to reduce our rearmament effort." Right now, Los Angeles county is the subversive hot spot of the United States because of the airplane construction,

L1335

Capt. Thomas J. Stinson, Jr.
3872 Franklin Ave. Los Angeles
Calif.



Stethoscope and rubber cup are held against a wall to pick up conversation of suspected saboteur in next room

Cutaway model shows construction of the magnesium and thermit incendiary bomb used in Europe

shipbuilding, and petroleum production congregated there. Recently Peck set up a laboratory in Los Angeles to deal exclusively with sabotage and arson and placed in charge of it Captain Paul Wolfe, nationally known arson expert.

Protection of the Los Angeles industries really starts hundreds of miles away, in the mountains and deserts from which the area draws its water supply and electric power. Aqueducts and power lines extend for hundreds of miles, and all are guarded by vigilant patrols and by other means.

What can you do in the fight against sabotage? Perhaps plenty, if you keep your eyes open. If you



Guards and searchlight on tower watch over plant employing 30,000 on army and navy work. Below are more guards, miles of fences and special floodlights



State Fire Marshall's
office. Chamber of Commerce
Bldg. 500 Angeles



Above, incendiary pencil and chemicals for starting fires. Left, incendiary burlap, gun cotton "card" and glass used to focus sun

live in the country, be on the lookout for clear glass marbles a little more than an inch in diameter that you may find lying on or near combustible material. Left alone, the "harmless" bits of glass may start disastrous fires. During the last year incendiary burlap pads soaked with self-igniting chemicals. Reading glasses set at an angle to catch the sun

and trained on strips of celluloid were also used.

This time, the glass marbles are appearing. A reading glass must be accurately focused to concentrate the sun's rays, while a round marble has a universal focus and can start a fire no matter from what angle the sun strikes it. If you find any such marbles, gather them up carefully, handle them with your handkerchief to preserve fingerprints, and report them to your fire or police department.

Aircraft are watched by armed guards at all principal airports today



Above all, be suspicious of any automobile that you think may have transported the marbles. Get its license number but don't trust the number to memory. Write the numerals down at once. If you don't have a pencil, trace them in the dirt or with a finger on a dusty surface. Twelve bad "marble" fires occurred in the wake of one automobile in the northwest last fall before the car was finally traced.

If you work in a defense factory your plant protection manager probably



Even an air-line mascot carries identification card and photo to enter the plant

has instructed you in some of the ways to guard against wrecking and fire. Various "tools" used in the last war are being employed again. One favorite that looks innocent and is harmless as long as it is kept upright is the incendiary pencil. Laid on its side, within a few minutes it throws flames that may extend for 15 feet. Hidden inside are two thin glass vials, each open at the top and each containing a chemical. When the pencil is dropped the chemicals spill and combine, causing terrific combustion. Fake fountain pens are similarly used. Lead cigars, shaped and colored to resemble real cigars, work the same way. A saboteur is apt to place them in the hold of a ship and other places where delayed ignition will make the fires harder to fight. It may take days for the chemicals inside to eat through the lead sheath.

For the last few months Wolfe has been conducting classes of instruction in scientific ways to prevent and detect sabotage. The classes are restricted to fire and peace officers and industrial safety men. It may be easy for a wrecker, as has happened, to

(Continued to page 176)



Capt. Paul Wolfe, arson expert in charge of the sabotage and arson bureau set up in Los Angeles, with his portable laboratory

A civilian guard makes the rounds of a vital bridge structure



m60

Sirens Perched on Traffic Signals Scream Blackout Warning



Traffic signals carry sirens; lights, left, ready for blackout

Air-raid sirens in Los Angeles, Calif., will sound their warning blasts from atop traffic signals where a convenient perch has been found for them. The stop-and-go lights, too, have been made ready for blackout. Each light is provided with a metal cover having a narrow slit through which motorists can see the light, but the beam is not brilliant enough for enemy observers to see it.

m65

Electroplating Method Pulls Iron Out of Low-Grade Ore

Low-grade iron ore, which has not been considered worthwhile shipping to the furnaces, is used in an extraction process developed through experiments fostered by Henry Ford. Electrolysis is the basis of the method, and the iron obtained has some unusual characteristics that make it useful in the new field of powder metallurgy. Iron is dissolved out of the ore in chemical solu-

tion, and then is recovered from the solution by a system of electroplating. One electrode becomes coated with iron 99 percent or more pure, which can be removed in sheet form. Since the metal contains a slight amount of hydrogen, it can be pulverized easily. Heating the sheet slightly drives off the hydrogen and the iron becomes ductile. In a single press operation the iron powder can be molded into high-precision gears which need no machining.

m12

Shop Lights Blacked Out By "Electric Eye"

Instead of employing a watchman to turn out night lights in his small shop when an air-raid alert is sounded, Andrew Tessier of Schenectady, N. Y., has installed an "electric eye" which performs this service unattended. Focused on a street light near by, the photoelectric cell is hooked up with the shop lights in a way that causes them to go out when the street lamp is extinguished and come on again when it is relighted. Since the city street lights are switched off the instant an air-raid warning is received, the shop also is darkened according to blackout regulations and stays dark until the city is lighted.

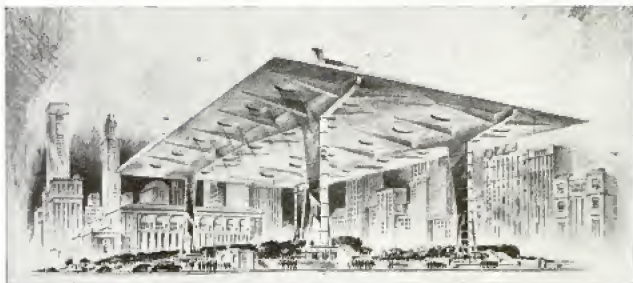


Photocell mounted in window is aimed at street lamp

21391

Isranh

Airport on Stilts Would Roof Over City Park



Helicopters or Autogiros operating in ferry service to outlying airports could land on this mid-city airport

A mid-city airport on stilts has been proposed for New York by Raymond Loewy, industrial engineer and now a consultant to the U. S. Army Ordnance department. Larger and larger transport planes of the future, he feels, will require longer runways, and airports must be built farther out from the cities. To get the passengers

to and from these distant airports he suggested helicopter or Autogiro service, with its downtown terminal an elevated landing field over some large mid-city park. Surfaced with an asphaltic composition, the airport would be supported by huge pylons enclosing elevators. Below street level a vast underground parking area is provided.

American Bomber's Power Dive Hits 560 Miles an Hour

Secrecy of war and the fast development of new planes are hushing many a record performance that would be front page

sensations in normal times. One of the most amazing feats was that of an American-built medium bomber that set a world



This Martin bomber with crew of three dived faster than 9 miles a minute

record recently by diving at 560 miles an hour—better than nine miles a minute. The event was not publicized until some time afterward. Three men were aboard the Martin "Baltimore" when it roared down in a 65-degree power dive at not much less than the speed of sound. A record crossing of the Atlantic by another U.S. bomber in eight hours, 23 minutes, similarly went almost unnoticed. An army flier took a P-34 Republic pursuit-interceptor plane from Lowry Field, Denver, to New York at 6½ miles a minute—1,800 miles in four hours, 43 minutes.

APRIL, 1942

Islema L. Martin Co. 33
Baltimore, Md.

Copyrighted material

10,000,000 "Hello's" A DAY



This is one of New York City's incoming long distance switchboards. A Corporal in the Signal Corps services Fort Dix telephone exchange.

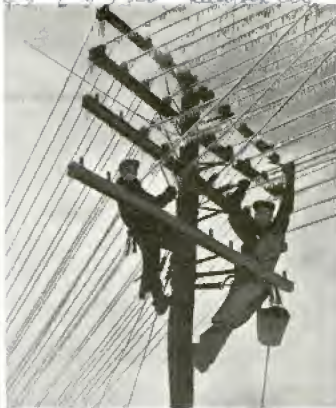


MOST people have thought of the telephone as a little black electrical robot which makes it possible to converse with distant friends, transact business, summon the police or fire department and, in some of the bigger cities, to get the correct time and the weather prediction. In the past few months, however, the telephone has become a clinical thermometer registering the rise of the defense emergency fever.

Increased telephone call volume has kept accurate pace with the national defense effort, and just now the nation is talking at a rate never before approached. In New York



On outskirts of New York a lineman repairs one of the 200-pair cables which contains 400 wires



Four-fifths of the city telephone lines run underground, but trouble shooters still have sleet to fight

City, for example, the daily average of phone calls is hovering near the incredible figure of 10,000,000 "hellos" each business day. In this one city, an average of considerably more than 100 persons dial a number every second.

Yet back in 1878 when there were 271 telephones in New York and its inventor, Alexander Graham Bell, was predicting that "wires will unite the head offices of the telephone companies in different cities and a man in one part of the country may communicate by word of mouth with another in a distant place," he was called a visionary.

Long before the war, engineers of the New York Telephone Company and the affiliated Bell Telephone Laboratories prepared for an emergency so thoroughly that when it came, it was no emergency at all. The result is that New York City telephone

dials are twirled at a rate of 300 or 400 a second during busiest periods and the little robots take it in stride.

Two remarkable recent improvements, little known to the public, are responsible for the boosted capacity of the system. One is the "electrical brain" or "crossbar office," an improvement on the "mechanical brain" or "panel type office" which

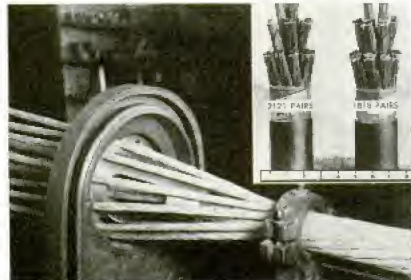


Average long-distance call takes 2 minutes to connect. Here an operator weaves an orderly tangle

21270



This operator makes recording of time; subscribers get it by dialing
Forming a 4,242-wire cable; inset compares the new and the old cable



connects phones in response to the dials operating nearly all phones in the city. The other is the method of packing 4,242 copper wires in a cable no bigger than a man's wrist.

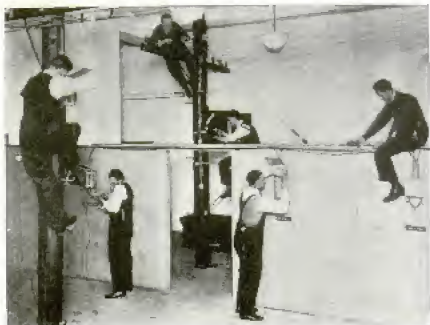
In "panel" type dial offices, the automatic connection is established largely by mechanical means. Finger-carrying rods move upward to grasp line terminals, directed by the impulses generated as you twirl the dial. The connection is completed when the last finger finds its terminal; whereupon the final impulse causes the right telephone bell to ring, or gives a busy signal. The whole

procedure averages less than a half second.

The new crossbar central offices have fewer mechanical parts. They establish the connection solely by opening and closing electromagnetic switches, or relays. The call is directed by a "sender circuit," the "electrical brain" of the crossbar central office. It reaches out ahead of the call to test connecting routes, selects one that is not busy and directs the closing of switches along that route. The action is largely electronic. When calls are measured by millions, this fast electrical operation means the difference between thousands of busy phones—and thousands of busy signals.

The feat of packing 4,242 separately insulated wires into a cable $2\frac{3}{8}$ inches thick was extremely important in a city the size of New York. If it were possible to maintain telephone poles in crowded Manhattan, an 860-foot pole, two-thirds as high as the Empire State Building would be necessary to

Telephone installers and repair men train with practical work indoors



carry the crossarms required to support the wires contained in this single cable.

Condensed as they are, the fact that space for some 8,000,000 miles of the city's nearly 10,000,000 miles of telephone wire must be found in a subsurface area already jammed with subways, light and power conduits, sewers, water, gas and steam pipes, leaves telephone engineers with a problem. Engineers of the Western Electric Company helped solve the difficulty with the newest cable, producing a covered wire with a diameter of 31/1000 inch. The revolutionary development came when they changed the method of insulating the copper wires. Previously, the wires were wrapped spirally with paper ribbon. Now, a machine manufactures a thin coating of paper, spreading it on 60 wires at once as they pass through a bath of pulp. Next, two are twisted into a pair, 101 pairs are bound into a unit, 21 units are twisted together and this core, after drying in vacuum ovens, is forced through dies which sheath it with lead.

The cables run through the streets in tile or iron conduits set in concrete and known as cable subways. Some of them carry

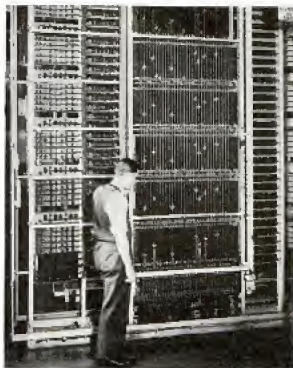
(Continued to page 171)



It looks like hopeless chaos, but the telephone service expert will bring this maze of wires to perfect operating order



↑ Inert nitrogen gas is being forced into the lead sheath of a 4,242-wire cable to test it for a break. If the pressure indicator falls, the gas is escaping somewhere along the cable



← This is the "mechanical brain" switchboard with its little disks that slide up and down on rods, grasping the proper line terminals under impulse of a dial twirled by customer

21391

Mobile "Catastrophe Hospital" Handles Major Operations



Mobile unit is equipped for hospital service at disaster scene

What probably is the most modern of mobile medical units in existence has been constructed according to the design of Dr. John B. West of Provident Hospital, Chicago. The "catastrophe hospital" can carry five doctors and six nurses to duty in such emergencies as bombings, fires and mass accidents. The ambulance is equipped to accommodate 100 minor cases and four major operations. In addition to hospital apparatus the vehicle carries short-wave radio, fire-fighting equipment and acetylene torches. It is convertible into a mobile army hospital.

Mercury Vapor and Steam Plant Produce Economical Power

By operating a mercury vapor engine in conjunction with a steam engine, electrical energy is produced at the rate of one kilowatt-hour for every half pound of fuel consumed, said to be a world's record. The power plant, located at Kearny, N. J., has been running for 15 months without a hitch under the eyes of General Electric Com-

Schenectady, N. Y.

pany's research engineers. More than 20 years of experiment preceded the building of the original plant in 1933. In the mercury vapor engine the top temperature usually reaches about 958 degrees Fahrenheit, and during expansion the mercury vapor is dropped to only 485 degrees. In so doing it drives a turbine and generator of 21,000 kilowatts capacity. At the lower temperature the mercury vapor becomes the "fire" of the steam boiler, which drives another turbine and generator of 30,000 kilowatts capacity, totaling 51,000 kilowatts for both engines. Through the years of research it was found necessary, in order to avoid troubles in the boiler, to add small amounts of magnesium and titanium to the mercury, and to exclude from the boiler all oxygen and oxides such as iron rust.

Hand Tool for Knurling Is Worked With Pliers

Slight pressure with one hand is sufficient to operate a knurling tool that works like a pair of pliers. Three knurls are supplied to accommodate diameters from $\frac{3}{8}$ to 2 inches, the tool or other instrument to be knurled being held in a lathe chuck, drill press or vise.



Simple hand pressure will operate this knurling tool

21353
Schenectady
Dec. 4, 1941

21147
N. Vermont
So. 3 4 4
Pacific Tool & Supply Co. Angeles

2129 0.

Applied Lighting

Lamp Hidden Under Shell in Laboratory Test

The quality and light-distributing ability of new lamps developed by Westinghouse are being determined with the aid of a steel sphere, called a photometer, which splits in two for mounting the lamps or to allow close inspection. An electric eye outside a small window measures a definite portion of the light which is permitted to escape from the sealed chamber. Powerful 400-watt mercury-vapor lamps tested recently proved of especial value for use in floodlighting and beacon lighting. It is estimated that their installation in the Statue of Liberty's torch would create a beam visible 10 to 20 miles at sea.

Examining the glass capsule of a powerful mercury-vapor lamp mounted in photometer. Goggles and a special filter shield the eyes when peering directly into the light source

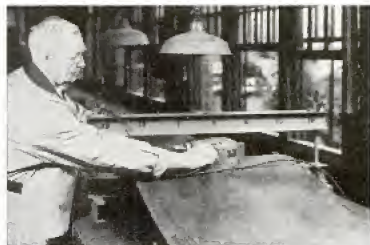


21383

Portable Unit Vulcanizes Patches on Worn Conveyor Belt

Small enough to be carried to the job, an electric vulcanizing kit can repair worn spots in conveyor belts quickly and easily. Consisting of an adjustable cutter and a

portable heating unit, the outfit uses sheets of vulcanizing rubber to make neat patches which prevent further deterioration of the belt. Circular pieces are cut from the patching material, and a hole of the same size is made in the belt at the worn part without changing the adjustment of the cutter. The patch then is put in position and the vulcanizer, weighing 50 pounds, seals it permanently by heat and pressure. The repair kit handles patches up to 10 inches in diameter.



Press and heat unit being prepared to vulcanize patch on belt

APRIL, 1942

B. F. Isarduck Co.
akron Ohio

Ⓐ monthly average of 55.2 tons of dust per square mile fell in Chicago last year, May being dustiest with 84.3 tons. One downtown spot averaged 134.9 tons.

Smoke Abatement
department report

39

2.10 24.

GATEWAY to the WORLD

Cmd. Allen Warren Elliott
342 & 33rd New York



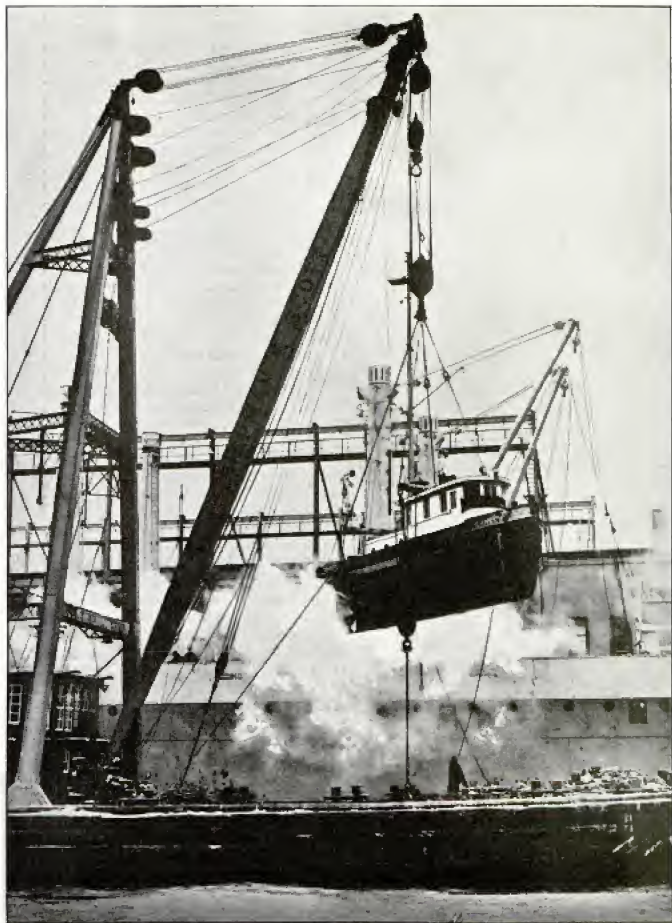
Floating heavy lifts do the hard work, such as transferring the big tank, around the harbors and channels of Port of New York



THE port of New York has passed its first test of the war as western anchor of the British Empire's lifeline, as repair point for many of Britain's warships, as host for hundreds of Uncle Sam's war vessels, as a huge shipbuilding center, and as the clearing place for raw materials and finished weapons in the defense program. And, on top of all this, it has the role of supplying many needs of more than 12,000,000 inhabitants in the immediate area.

During a recent month, 1,170 vessels of a net aggregate of 3,935,099 tons, a large percentage of the whole world's shipping, arrived and departed. Today the total is even larger, and the port, which is big enough to hold every ship afloat on the globe, is operating at a higher pitch of activity—but still smoothly—a decided improvement over the days of World War

Fleet of liners berthed in Manhattan docks of Hudson river, Port of New York and its harbor could berth every ship afloat



Even the ships themselves can be shipped in New York's harbor—this photo shows a tug, destined for South America, being lifted out of water to be placed on a large cargo vessel which will transport it to its destination. No job is too big

710 24 (Cooler Control Telling)
 Mercury 41 46
 1024 (Cooler Control Telling)
 710 24 (Cooler Control Telling)



One man does work of several with these automatic tractor-type carriers which not only transport merchandise, but stack it high and neatly



Tug handling freight-car floats loaded with 27 cars. This helps prevent railroad congestion

Cross-section shows how vehicular tunnels are → freed of perilous exhaust fumes

No. 1 when the port was regarded as a huge bottleneck.

Up the great bay, past the Statue of Liberty, slide the motley vessels of dozens of nations, loaded with copper, coffee, sugar, beef, lumber, coal, tea and other raw materials needed here. Down go these ships, pressed low in the water with airplanes, ammunition, guns, tanks, machinery, and food and products that have been processed in America's plants.

After the sad experience of the last war, the states of New York and New Jersey agreed to erase boundary lines and proceed with development of the port under a single body, the Port of New York Authority. What has happened meanwhile explains how the port has become gateway to the world, a huge focal transportation point 1,500 square miles in area, with wharves, piers and quays extending along 650 miles of waterfront and embracing hundreds of municipalities and civil subdivisions. And

how 120,000,000 tons of commerce valued at more than \$10,000,000,000 is moved quickly even in a normal year.

The problem was found to be mainly that the very harbor, rivers, canals and inlets which made the port the greatest in the nation were the cause of delay because they separated the New Jersey shore from the shores of Manhattan Island, Staten Island and Long Island, all of which are parts of the New York metropolitan area, and even these sections of New York were not sufficiently well linked with each other to



George Washington
Bridge

21024



Approximately 8,500,000 vehicles a year pass over this Hudson River crossing



"Vacuum cleaner" arm of Army dredge being lowered to suck up tons of debris so New York harbor channels may be kept open

move either passenger or freight traffic with dispatch.

With other organizations, state and municipal, following the pace set by the Port Authority, 26 crossings have been constructed in about two short decades, including the Holland Tunnel, Lincoln Tunnel, and Queens Midtown Tunnel, the George Washington Bridge, Triborough Bridge, and the Bronx-Whitestone Bridge, any one of which would be considered an engineering feat of first magnitude in itself. Preliminary work is under way on yet another tunnel, the Battery-to-Brooklyn tube, which will extend to Brooklyn from the lower tip of Manhattan. These bridges and tunnels enabled trucks to take part of the load from ferries and lighters and the bottleneck was broken.

Western Electric

Wire and cable, much of it used for military operations in war zones, being loaded onto merchant vessel



(Continued to page 162)

21378 *Edgar K. Brown, manager photography dept*
Photo Studio Lifts Set Into Focus by Auto Hoist

*Carb. A. Crisis 475-57th Ave
 New York City*



Taking photographs from directly above machinery and other objects has been simplified at the photographic studio of Camp Holabird Quartermaster Depot, at Baltimore, Md., by mounting the camera in a trap-door opening 18 feet above the floor, and arranging the subject on the platform of a hydraulic hoist at floor level. Operating like an automobile hoist, the elevator lifts the subject to any position up to six feet in height for the best advantage in shooting the picture.

Camera takes picture from trap door (left) when hydraulic hoist (below) lifts set within focus



21351 *New York Times
 Dec 4, 1941*

4.7-Inch Antiaircraft Shell Soars Beyond 30,000-Foot Height

Latest weapon for fighting air raiders is a powerful new antiaircraft gun capable of hurling shells to heights beyond 30,000 feet. Its caliber is 4.7 inches, or 120 millimeters, and it is said to be one of the mightiest weapons ever turned against high-altitude bombers. The possibilities of such a gun were first determined mathematically in the United States Ordnance Department office, and then were tested by retubing a larger gun to 4.7-inch caliber.

*New York Times
 Dec 18, 1941
 Service*

Old-Fashioned Weather "Signs" Come to Aid of Amateur Forecasters

Now that tomorrow's weather is a military secret, backyard weathermen will make their own predictions by observing old-fashioned "signs," some of which have a scientific foundation and are quite reliable. For instance, the old jingle, "Red in the night, sailors' delight; red in the morning, sailors take warning," is founded on the fact that bright sunsets with red-tinted clouds occur during settled weather, whereas a bleary, reddened sky in the

morning or any other time of day indicates moisture-laden particles in the air which may bring rain or snow. A column of smoke continuing upward from a chimney means that the air is dry, but if the smoke goes up and then settles down again it shows the air is heavy with moisture. The moisture, mixing with the smoke particles, makes them so heavy they sink. A ring or halo around the moon provides another weather sign; so does a fuzzy or blurry

appearance of the moon or stars. These phenomena are due to the interception of light by thin clouds running ahead of an approaching storm area. However, put no belief in the saying that the crescent moon "holds" rain if its horns point upward, and "pours" rain if they point downward. The causes involved are purely astronomical and have no connection with the earth's weather conditions. This also holds true concerning the position of the "bowl" of the Big Dipper.

—21374.

Sliding Measuring Stick Shows Height of Child

Proud parents desirous of recording the periodical growth of their children might consider the convenience of a collapsible measuring stick now available. Besides the inch and foot markings, the rule contains comparative figures showing the average height and weight of boys and girls at various ages. Extended to the maximum limit it will measure children of the average nine-year-old size.



Rule expands to measure a growing child

Super Mercury Lamp for Industry Speeds Defense Production



Mercury lamp, 55 inches long, provides efficient light for industry. Statuette on table is Mercury, Latin god of commerce

Better lighting for industries at work on defense contracts is offered by a far more powerful mercury lamp developed by General Electric. The new 3,000-watt Mazda AH9 mercury lamp is rated at 120,000 lumens—eight times more powerful than the nearest rival among its kind. Yet its 55-inch length is only four times that of the 400-watt mercury lamp, heretofore the largest and chief source of light in many factories. It is barely more than an inch in diameter. In trial installations the lamp provided more than 50 footcandles of light at the working level, compared with the average factory illumination of less than 10 footcandles. This abundance of light provides swift and accurate seeing qualities and is expected to prove a vital factor in speeding defense production.

Write to the firms listed in the Where-to-Buy-It index to learn more about products described in this magazine. Say You Saw It in Popular Mechanics.

IF *the* AIR RAID SIREN



↑ Coastal areas of the United States, at least, are in peril of bombing and the citizenry must be prepared. It is well to fill the bathtub with water, and bottle some drinking water, lest city water mains be broken

Stock up the room you select for your air-raid "shelter" with the necessities—jugs of water, Thermos bottle, flashlight, candles and matches, a first-aid kit, chocolate, magazines and cards for diversion

To be ready for the incendiary bomb, keep a hose attached to the water faucet. On the bomb itself use a fine spray, since a heavy stream of water will make the magnesium flare explosively ↓



Gas burners should be turned off during raid; it may be wise to cut off gas at meter, but consult utility office first

First thing to do in a blackout is to blanket all the windows. Don't wait until the emergency comes to plan this ↓



End. Arthur. Harg. Art. Sept.

SHRIEKS

In the small house, safest place is the basement (right), since upper floors will probably stop incendiary bombs. There should be a safe exit in case of fire. Get the family downstairs quietly at the first alarm. Avoid appearance of panic, for children learn fear from their elders. Stay away from windows, which should be taped to prevent shattering



In the attic, left, where most incendiaries lodge, keep buckets of sand, a shovel and a rake or other tool for handling flaming bomb. Dry sand, graphite and similar inert powders will smother a magnesium bomb in a few minutes, but beware of wet sand and ordinary extinguishers

When bombs fall, get under a sturdy table in the basement. There, in the event of a near hit, you will be protected from debris or even a cave-in of the floor above. These suggestions are based on experiences of London; for advice on peculiar local conditions look to your community civil defense board



L1334

Steam Bag for Private Bath Designed for Home Use



Steam-bath bag receives vapor from unit on the floor

Steam baths may be taken in your own bedroom with a private bath bag that receives its vapor from a separate, compact unit. Made of rubberized material, the bag closes about the neck of the bather by means of a slide fastener, and the turn of an electric switch starts production of steam. Head and arms are left free for reading, smoking or answering the phone.

L1341

Versatile Repair Tool Cuts Metal And Irons Out Car Fenders

Repair work on auto bodies and fenders may be done quickly with a pneumatic tool



"Ironing out" fender, left, and working the beading

Chicago Pneumatic
Tool Co. 6 E 44 St.
New York City

George M. M. M. M.
Waltham Cross

that "irons out" dents, wrinkles and rough spots. It pounds metal without stretching it, since the piston does not strike the metal directly, but transmits the blow through a die held firmly against the surface. Auxiliary attachments are available, one for cutting panels and sheet metal into various shapes and another for putting a beading design on fenders.

L1348

Creepers Track, Wheel Fit Truck To Lay Its Own "Road"

Tractors and trucks may be converted into track-laying vehicles by equipping them with a creeper track operated by a single sprocket-wheel, introduced recently in England. The track is made of six rigid steel links or sections, and a flange of the sprocket-wheel rides on the edges of the narrow channels of each section. As the sprocket-wheel turns it lays one section after another in front of itself, so there are always one or two sections on the

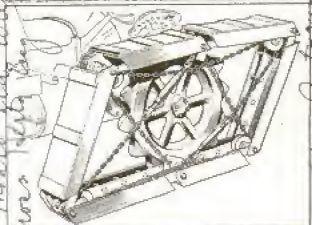


Photo and sketch show how track and wheel operate ground to ride upon. Tensioner chains join the sections to help support the weight of the vehicle when the sprocket-wheel passes over the joint between any pair of links. For use on six-wheeled trucks, the track is formed of eight sections instead of six, enabling it to encircle the two-in-line driving wheels.

POPULAR MECHANICS

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Bumper on Bomber Fends Off Balloon Cables



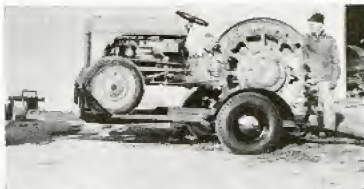
Heinkel bomber downed in England was found equipped with projecting fender to ward off balloon cables

In an effort to cope with cables that hang from barrage balloons over England, German bombers are being equipped with a wedge-shaped bumper intended to protect the entire wing span and fuselage. One of these fenders was found intact on a Heinkel

bomber forced down in Britain. The Royal Air Force is also experimenting with protective devices, but the British fender is a smaller one designed to cut the cables, and is said to offer less wind resistance than the German version.

All-Steel Trailer Carts Tractor at Fast Driving Speeds

Tractors and other farm vehicles can be hauled at fast driving speeds from one job to another by loading them onto a two-wheel, all-steel trailer for automobile or truck. Hinged loading ramps permit the tractor to climb aboard under its own power, after which the ramps lock in raised position to hold the trailer securely. At the destination, the ramps can be lowered for unloading.



Two-wheeled trailer hauls tractor or other farm equipment

Small-Size Demagnetizer for Tools Aids Removal of Metallic Chips



Passing tool over demagnetizer helps remove chips

Metallic dust and chips adhering stubbornly to tools held in magnetic chucks must be removed in order to preserve the cutting edges and prolong the tools' useful life. Such removal may be accomplished more easily with the aid of a small but powerful demagnetizer now available. A single pass across the magnetic poles of the instrument completely demagnetizes drills, punches and dies, breaking the hold of tiny abrasive particles of metal. Operating on 115 volts and 50-60 cycles, the demagnetizer weighs 17 pounds and measures 4½ by 5¼ by 10½ inches. A pilot light indicates when the current is on.

Master Blumberg Co.
New: Andstein, W. is

2736

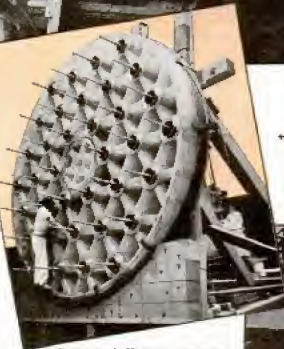
SUPER - CAMERA of the SKIES



One of the main driving gears of the telescope had to be cut in a special constant-temperature room

← Counterbalances attached to projecting rods will prevent the slightest warping of mirror as it is tilted

Cleaning the surface of the mirror glass after partial polishing. Every stage requires extreme delicacy

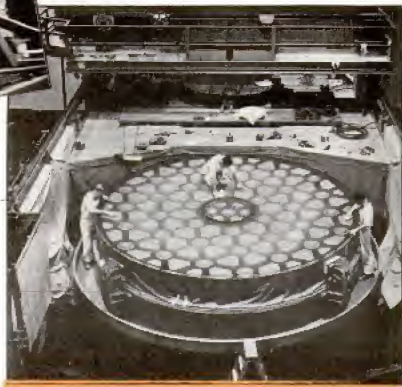


Photos by O. K. Harter, Pasadena

By Dr. R. M. Langer
California Institute of Technology

EVERY month some 10,000 people drive to an observatory on top of a mountain in southern California. They stay usually about 20 minutes. Then they go away, fully satisfied and, perhaps elated over their visit to the world's greatest telescope.

Except for the installation of the mirror itself, the telescope is a finished machine, delicate for all its



Paradise, Calif



Here an overhead crane in the Mt. Palomar observatory is being used to assemble the telescope

400 tons of moving parts, compact in spite of girders 60 feet long. Since it will move continually after dark it might be called a gigantic watch, accurate to a hundredth of a second.

One of its main bearings is 48 feet in diameter. It is so finely balanced that a man could push the whole 400 tons around. Yet it is not mounted on ball bearings or rollers. These would squash out of shape

with the weight, so the telescope slides on oil pads instead.

This enormous watch sags under its own weight; but it is designed so that no matter in what attitude it is pointed, it sags into instead of out of the proper shape to keep good time.

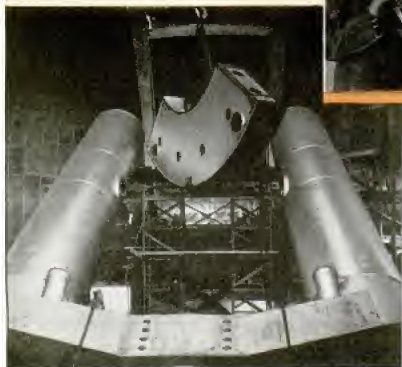
Wouldn't you like to look through the 200-inch telescope, sometime when you visit Palomar Mountain? Forget it. You



Size of workmen assembling part of telescope gives impression of its gigantic dimensions

Dr. J. A. Anderson, in charge of project, with a celluloid model of the 200-inch telescope →

Below, the telescope structure is being assembled inside the dome atop Palomar mountain
Two lower photos by O. K. Harter



haven't a chance. There isn't time enough. Besides, you would see just as much by looking through a six-inch telescope.

The six million dollars of Rockefeller money invested in the telescope plus the limitations of usable time put a price on observing time of several hundred dollars per hour. Even astronomers feel they will not be justified in merely peering through the telescope. They are the best observers of all science but they don't trust their eyes that much. They take photographs instead. A long exposure reveals faint details that their eyes wouldn't catch and they can re-examine their plates at will.

Outstanding pictures will

be put on exhibition at the new museum building for the public. They will constitute the world's best photography.

Astronomers are jealous of their observing time. A man prepares for days before his turn comes. He works at high tension during the exposures and then, if he had good luck, spends months interpreting the results. An event that is missed is never recovered. A flare-up of a

1736

star may occur, a spectacular comet may appear, or an eclipse take place at any random time. Somebody had better be watching!

So the telescope, so accurate that it might be called a watch, is truly no more than a mechanism for pointing a camera and moving it opposite to the rotation of the earth.

The great Palomar telescope is like nothing that went before it. The engineering had to be done specially for every feature. The part that is called the telescope tube is open and looks more like a bridge truss. There won't be any lens at all. The optical work is to be done by a curved mirror in the bottom of the tube—the famous 200-inch mirror. The observer or photographer may be stationed at the upper end of the tube where the light from the mirror comes to a focus. For some purposes auxiliary mirrors will be used to deflect the beam and bring it to a focus elsewhere in the observatory.

The tube can point the mirror at any part of the sky. The mounting, driven by gears of utmost precision, moves so that the tube and mirror keep pointing at the object. If, during the operation of the telescope, the aim of the tube fluctuates by so much as a foot in 100 miles, the error must be corrected at once.

Today a dummy concrete mirror, with a 12-inch glass mirror mounted in it, has been placed in the cell at the bottom of the tube. A year is being spent in putting the telescope through its paces. The complicated motions through which the machine must operate are being tried, studied, and if need be corrected, so that when the big permanent mirror is in place no time will be lost in getting results.

That mirror is now in Pasadena, being polished and tested in the optical shop of the California Institute of Technology—mostly tested. That will go on for at least another year, possibly longer. The work becomes more nerve racking as the end approaches. The mirror is 16½ feet or 200 inches in diameter. That means there are more than 200 square feet of hard pyrex glass that must be shaped into a parabolic surface. No region of the surface may deviate from perfection by more than a millionth of an inch. This accuracy must be maintained at all temperatures and in all positions of use. The mirror when polished

(Continued to page 178)

APRIL, 1942

21340

Power 'Wrench' on Wheels Opens Car Hoppers



Motor-operated wrench engages hopper mechanism

Speeding up of defense factories is aided by a "wrench" truck that opens and closes hopper railroad cars with great rapidity, thus hastening the unloading of raw materials. Run by either a battery or gasoline-electric power, the motor-operated wrench engages the locking device on the car gates to open or close them.

Air Release in Rubber Stopper Protects Vacuum Bottle

Fitted with an air vent that may be opened and closed, a rubber stopper for the vacuum bottle may be put on and removed with less difficulty. Through the center of the solid rubber stopper is a small tube topped with a screw cap.

Unscrewing the cap releases any air pressure bearing against the stopper from within, or, in other cases, it will let in air for easy removal of the stopper whenever a vacuum has been created by condensation of hot vapors.

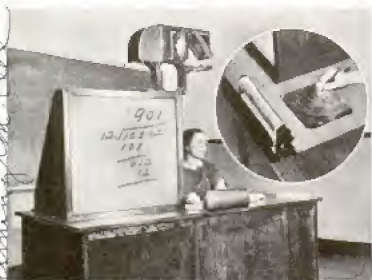


Sold by - Goldblatt
Bro. & Co. Inc. material
Bureau - Chicago

Cleveland, Papper, Cledon Co.
4205 St. Clair, Cleveland, Ohio

214 10

"Blackboard" on Teacher's Desk Reflects Writing From Pad



Screen reflects figures written on desk as shown in the inset

Educators can use visual methods of instruction to better advantage with a "Scriptoscope," which permits them to face their audience and have their drawings and writings projected on a large screen at the front of the lecture desk. The lecturer would illustrate his discourses by writing on rolls of Cellophane stretched over a 10-inch plano-convex lens on top of his desk. A beam of light from above the desk is directed through the plano-convex lens, and a system of lenses and mirrors intercepts this beam and projects it on the 24-by-30-inch screen. The screen may be placed above or below the desk top, and can be used in a well-lighted room, provided it is shielded from direct rays. The rolls of Cellophane make a permanent record of a lecture and may be used many times for the same lecture. Complex sketches prepared in advance may be slipped under the Cellophane, and the lecturer may make notes over them on the Cellophane without spoiling the sketches.

Radio Detector for Surgeon Spots Metal in Wounds

Pearl Harbor saw the first use of a radio instrument for locating metal fragments in wounds. Col. John J. Moorhead of New York happened to be lecturing to physicians in Honolulu when the Japanese attack occurred. Taking with him the new instruments, he accompanied the doctors to the Schofield Barracks hospital where the radio detector, located shell



Smashed auto warns drivers to take thought for their safety

fragments or bullets in 20 patients that day and proved the absence of metal pieces in many others. Quicker and less costly than the X-ray, it does its job in a few minutes. It consists of a radio-frequency circuit mounted in a box, with a movable coil attached by a wire and enclosed in a steel finger. The finger is one-half inch in diameter and 12 inches long, watertight and its wire rubber-clad for detaching and sterilizing. As the indicator approaches a piece of hidden metal the milliammeter shows it by a deflection. The indicator is moved around the wound in two planes at right angles to spot the exact position of the foreign body. It can be introduced directly into the wound if necessary. The instrument weighs only ten pounds.

Wrecked Auto on Pillar Warns of Perils Ahead

Autoists touring the famous mountain road from Laguaira to Caracas in Venezuela—eight miles as the crow flies and 22 miles by car—are reminded of dangers ahead by the remains of a wrecked automobile. Because the tortuous highway has been the scene of hundreds of fatal accidents, the battered car was mounted on a pillar where motorists cannot miss its message of warning.

54 Mr. Triplett
Electrical Classrooms C
Bluffton, Ohio

"Eggs" for the Air Force Are Precision-Built



Black Dior Gun Co.

Things of streamline beauty and scientific deadliness are the bombs fashioned for the Royal Air Force in assorted sizes and shapes suited to specific purposes. They range from 25 pounds to 1,000 or more, the impact bombs blunt-nosed, delayed-action and armor-piercing bombs pointed. At top, a coat of khaki paint is sprayed on, and it is also varnished



Small but lethal is this pellet being inserted with some delicacy in the bomb casing. Inside is a mixture of the color and consistency of honey; it's a pellet of T.N.T.



Above, screwing down the lid on a loaded bomb. At right, a trainload of "eggs" is inspected as it rolls into underground storage. The new armor-piercing bombs require harder steel, more complex mechanism, better balance, curves machined to a tolerance of hundredths of an inch. Used specifically to attack shipping, they are timed to explode after piercing the deck; this also gives the bombing plane a few seconds to get away from the blast. The R. A. F. has a secret bomb for attacking submarines, and still another for demolition, supposedly tremendous in size. This bomb is reported to have four times the explosive power of any other



1023
 Club Thomas E. Stinson Jr. 3872 Franklin Ave
 Los Angeles



To learn the rhythm of the swing, try swinging the club back and forth like a pendulum, as is being done here. You'll soon get the feel of it

Below, beginner stands comfortably, eye on ball, then raises light club no more than shoulder high and swings naturally, eye still on ball



IT'S ALL IN THE SWING

By Paul Scott

Golf Professional, Griffith Park Municipal Courses, Los Angeles

"YOU lifted your head." "Your left foot was too far forward." "You didn't pivot enough." These are comments you are apt to get when you make a poor golf shot.

Forget them. Your critics mean well but such advice will do you harm. Your fault was that you didn't swing your club head rhythmically. When you do, all other faults correct themselves.

Generally speaking, that's the

Multi-exposure picture of golfer driving, each position of club spaced 1/20 second apart
© A. G. Spalding & Bros., Inc.

one fundamental of good golf. When you learn to swing the club head smoothly and rhythmically and let the body take care of itself you will be on the way to playing better.

The golf swing is an easy, natural motion, just as throwing a ball or chopping wood is done with easy motions. A woodsman is awkward the first time he cuts down a tree and he gains proficiency with practice. He doesn't increase his skill by trying to pause or not to pause at the ends of his backstroke or by remembering to keep his elbow close to the body. That would be ridiculous.

Fifteen years ago professional instructors had hundreds of suggestions for their students. I, for one, taught golf the hard way, showing a pupil exactly how to stand, exactly how to hold the club, what to do with the ankles, and so on. The result was



that the pupil unconsciously overdid every point that he could remember and his swing suffered.

Today I don't care, within reason, how a pupil stands or the way he holds his clubs. All I ask is that he stand comfortably and swing the head of his club rhythmically. He may look awkward at first but I try to restrain my desire to make obvious corrections. Left to himself, he gradually shifts to an easy rhythm of movement. He practices with a 5 or 7 iron, one of the shorter clubs with a heavy head. He shouldn't try to imitate another player.

Look at it this way: It takes force to hit the ball and this force is the product of weight times speed. The club head is the weight and the faster it travels the farther the ball goes. You get the fastest speed through a revolutionary action and that is why we swing the club. In a full swing the club head travels some 24 feet and at the half-way point is moving perhaps 100 miles per hour or more. A player who makes long drives may put 150 miles per hour on his club head. High speed is what you want and any deviation from a perfect swing

Here, completing swing begun on page opposite, club has knocked ball away and player follows its flight as club head moves up to finish the swing



Double exposure of two positions in swing, one showing top of backswing with wrist cocked, the other at point when uncocking of wrists begins



One stage of follow through, with player, Lawson Little, still keeping eyes on spot where ball was
© A. G. Spalding & Bros., Inc.

kills this speed. Don't worry about the path that the club head travels in; it will be proper when the club is swung.

Strength isn't going to help. One hard hitting golfer may weigh only 125 pounds and may be convalescing from an illness. Another player may weigh twice as much and be eight times stronger, yet he hits a ball only half as far. The difference is that the weak player has learned to swing.

Try this: Hold the end of the club between the thumb and forefinger of the left

hand. Swing the club head back and forth like a pendulum half a dozen times. Notice its time and rhythm? Now, without stopping the pendulum motion, grasp the club with your right hand, shift the grip of the left, and without interruption swing the club in the same rhythm. It was a perfect swing, wasn't it? That's what you are after, every time.

But you want a larger, faster swing than this. That comes from developing your sense of feel to swing. Your hands hold the club at the grip and you must train them to sense and swing the club head. That takes practice. Don't try to keep your body still. The club head exerts a centrifugal pull and your body should respond to this naturally. Don't try to whip your wrists or to shift your weight from one foot to the other. When you are swinging properly you will do everything else properly and automatically, particularly after practice. Lack of practicing the swing is why the average player keeps shooting high scores.

To become a good player

Using "come back" type of board for practicing putts in your own yard



21023

you ought to practice the swing for an hour a day. This is true whether you are just learning golf or whether you have been playing for years. Tee up a cotton practice ball and swing. Hitting the ball is an incidental part. You are trying to make a perfect swing. Don't swing the club more than shoulder high until you are hitting the ball smoothly and easily. Watch the ball until it is struck, then watch its flight. Don't worry about hitting a straight ball. It will fly straight when the swing is correct.

Now and then, go back and swing the club between your fingers to remind yourself of the rhythm of the pendulum. When you are consistently hitting straight balls for about 25 yards with an easy swing you may begin practicing with some of the longer clubs. And

(Continued to page 166)

not a marked



Protective cage worn by ball-retrieving boy on driving range

Lightweight car, built by a greenskeeper for traveling around golf course on inspection trips, prevents damage to course

see Mar. 9 34 469

similar



↑
This is a recommended way to grip the club; try it yourself



The inventor of the car

APRIL, 1942

*built by - Mr. Scott
3042 Wellington Ave*

59

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Powerful Crane on Tow Truck Lifts 15 Tons



Crane mounted on towing truck by Canadian highway workers hoists heavy-duty tractor reported to weigh 10 tons

Here the telescoping arm stretches full length to pick up a small truck disabled in an accident on a road in Quebec



For use in handling difficult towing jobs, the Ministry of Roads of the Province of Quebec, Canada, devised and built a towing machine capable of performing heavy work. A crane that can lift 30,000 pounds, or tow 12,000 pounds, was mounted on a 3½-ton four-wheel-drive truck. It is equipped with five hydraulic cylinders, all operating independently.

Portable 1,000-Watt Generator Lights Fireman's Spotlight



Spotlight run by portable generator helps fight fires at night

Firemen fighting night fires are aided by a portable lighting plant carried at the side of a Dodge truck placed in service recently in California. It includes a 1,000-watt generator, completely portable, run by a gasoline engine. A 500-watt spotlight, plugged into the generator, can be operated from the point of best advantage for fighting a fire. It is expected to be of special value in combatting fires caused by sabotage and air raids.

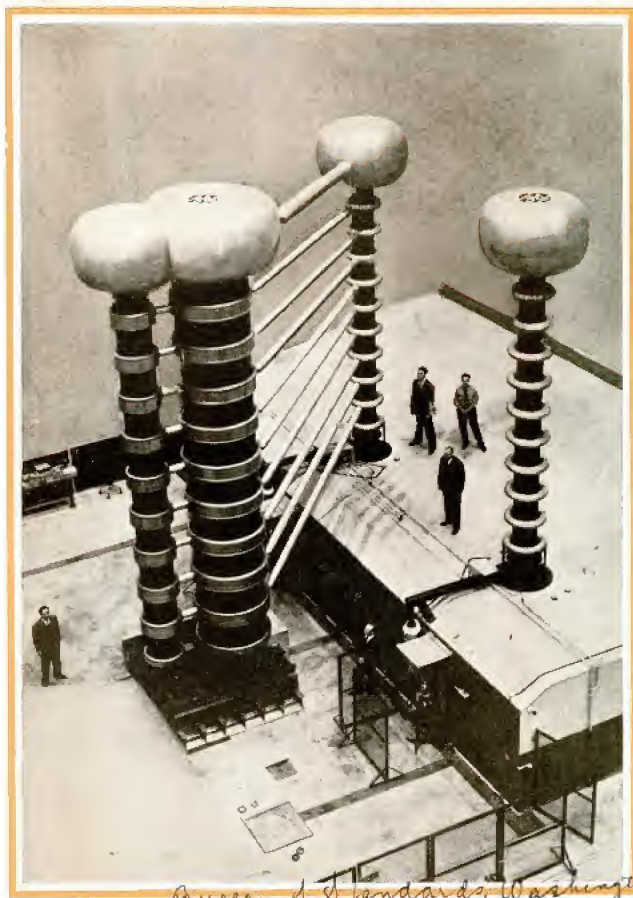
Look in the index to find where to buy articles described in this magazine. Say You Saw It in Popular Mechanics.

POPULAR MECHANICS

Homelite Corp. 617 E. material
attn. Mr. Bullock Bldg. Los Angeles Calif

213/6

Mightiest X-Ray Hurls a 1,400,000-Volt Beam



Bureau of Standards, Washington

Uncle Sam is owner of this towering array of aluminum and herkallite, the world's mightiest X-ray. The 1,400,000-volt machine built by General Electric is used to measure medical X-ray dosage and test protective materials. Its radiation equals that of 14 pounds of radium—\$150,000,000 worth, if it could be had. Large column, 30 feet 6 inches high, weighs 18 tons, contains direct-current generator; those at right house X-ray tubes

Trap for Incendiary Bombs Smothers Their Fire

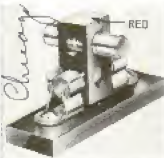


Scooping up bomb. Handle may be extended 25 feet

Incendiary bombs can be robbed of some of their destructive power by using a long-handled scoop, invented by Dr. Nathan Mininberg of New York City, which works like a mouse-trap in snaring and extinguishing a bomb. The handle is made in three sections, and when assembled it permits an air-raid warden to handle bombs from a safe distance of 25 feet. He simply scoops the bomb in shovel fashion, and as the bomb strikes a release at the rear of the trap, a door springs shut, smothering the blaze within the asbestos-lined chamber.

Fuse Holder Carries a Spare Ready for Instant Use

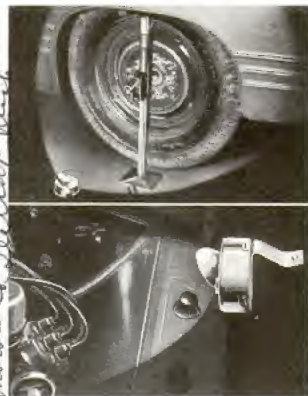
Having an extra socket for a spare fuse in a fuse holder and puller provides for quick



Red end pointing outward reveals a blown fuse

replacement of burned-out fuses. The holder is a rectangular block of soft rubber in which holes are bored to receive two fuses, being narrow enough to leave the caps protruding at both ends. When one fuse is inserted between the clips, the other fuse remains at right angles at the opposite end of the holder, making a handy grip for pulling the fuse. When the fuse blows, the operator simply pulls the holder and reverses it in the clips, putting the spare fuse in the circuit and bringing the blown fuse toward the outside. One end of the holder is painted red, so when it has been turned in this manner the serviceman can tell at a glance that the fuse has blown, in which event he replaces it with a good one and again reverses the holder.

Trouble Lamp Over Car Engine Lights When Hood Is Lifted



Lamp mounted under hood and used on road (top)

Lighting automatically each time the hood catch is released, a combination under-the-hood and trouble lamp is an accessory offered by Pontiac. The lamp is installed over the battery on the left side of the car, a 14-foot cord permits extending its illumination for tire changes and a broad base gives it a steady footing on uneven ground. Under the hood it gives sufficient light for inspecting the oil stick.

21325
"S O S" Signal in Colored Smoke Seen 30 Miles



British canister
Column of orange colored smoke rising from sea can bring help to seaman from distance of 30 miles

Shipwrecked men and airmen down at sea can send a visible "S O S" with a new life-saving device tested by the British Ministry of Shipping. It is a small canister, known as the Wessex daylight smoke sig-

nal, which releases a cloud of orange colored smoke when its trigger is pressed. The smoke rises continuously for an hour, increasing in intensity until the column is visible for 30 miles or more.

m-3.
Working Model of 'Flying Wing' Undergoes Ground Tests

Another "flying wing," said to be especially adapted for use as a carrier-borne fighting plane, has been completed in working-model form. While running the mock-up of his invention through ground tests at the Municipal airport at Baltimore, Md., the designer, Cheston L. Eshelman, said he planned to build a larger ship and submit it to the Navy.

Looking as much like a bug as on airplane, this "flying wing" model was put through its paces on the ground at Baltimore Municipal Airport to test the inventor's theory



Blackout Hood Fits Lens Of Auto Headlight

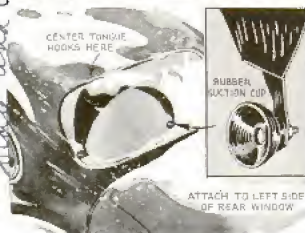


Blackout hood fits over headlight of government car

To black out automobile headlights during air-raid alerts, a special shield has been designed with the approval of the Department of Justice. It slips easily over the lens and makes the light completely invisible from the air.

Snow Visor on Rear Window Keeps View Clear in Storm

Auto drivers can keep snow from blocking rear vision in a blizzard by attaching to the outside of the back window a small visor now available. Made of metal and fitted with two vacuum cups which grip the glass, the visor forms a kind of hood



Suction cups hold the shield on rear auto window

Arco Co. (Cleveland, Ohio)
7301 Bessemer
over a large portion of the window, keeping that area clear of snow accumulations and assuring clear vision at all times. A small lug at the top of the visor slips between the window and top edge of the frame, providing a firm mount.

Camouflage Paint for Gas Tanks Deflects Heat Like Aluminum

Storage tanks for gasoline and other volatile liquids can be made almost invisible to enemy bombers by a low-visibility paint, just announced. Although dark in color, this paint reflects heat almost as well as aluminum paint, formerly favored for keeping oil tanks cool but now unsuitable because it makes a brilliant target visible for miles. The new paint can be used for camouflage in green, tan, black or four intermediate shades.

Traveler's Whisk-Broom Holder Has Handy Shoe Polisher



Shoe-shining pad is covered by flap when closed

Unfastening the snap of a whisk-broom holder now available reveals a square pad of wool for polishing shoes. This may be done while the whisk broom remains in the holder, but when it is removed the fingers can be inserted to obtain a steadier grip. The set is small enough to fit the coat pocket, or auto glove compartment.

Clementy Products Co.
Rochester, N.Y.

21414

Mammoth Concrete Spreader Straddles Canal



Mechanical concrete spreader straddles canal as it lays concrete bed and trowels it to smooth finish

Operating under its own power, a huge concrete spreader and mechanical trowel performs the entire task of laying a bed of concrete in the bottom and sides of a section of the Contra Costa canal in California. With its underside extending downward to within a few inches of the canal bed, the giant straddles the canal, riding on rails

along the upper level. As it passes overhead, the machine distributes a three-inch layer of concrete over the bottom and sloping sides, vibrates the concrete into a dense, compact mass, and completes the job by imparting to the surface a smooth finish. The canal is being built by the United States Bureau of Reclamation.

Ten-Mile Beam of Army Light Signals to Planes or Cars



Communication between army forces on the ground and in the air has been facilitated by a new experimental signal light used by the 142nd Signal Company, attached to the Second Armored Division. It can be used also in transmitting messages between cars in a column. At night the light can be seen ten miles, and up to a half-mile in daylight.

Signal light operated from army truck may be seen 10 miles away

The RACE HORSE goes to SCHOOL



Top, slipping a rubber "beginner's bit" into horse's mouth. Center, a high-strung youngster, never ridden, gets a lesson by running alongside another horse

LIFE for an American race horse is a strange combination. Receiving all the service and adoration of a prima donna, the thoroughbred is worked like a slave. From the time he is a year old, he begins the rigorous training that will bring him in a winner, a champion, or just another also-ran.

How great a winner he becomes does not all depend on his speed and heart; to a tremendous degree, it depends on the men who work with him, coax, pet, love, nurse him, while they discipline him like the toughest top sergeant. It depends, too, on his ancestry, for the future of the thoroughbred is determined in large measure before he is born. Not many humans can trace their ancestry more than three or four generations, but the race horse can trace his for many generations. Before the horse was bred, experts pored over the records to determine what good and bad characteristics might be expected.

→ Tying up horse's head so that too much pressure on the bit will not be necessary while bit is still strange





Saddled and with long reins (top) the horse learns first commands, grows used to harness. Right, three men hold horse when first mounted; one holds lip to prevent tossing

Training for the track's begins almost with birth, although the hard work does not come until later. These blooded creatures are aristocrats, and they seem to know it. Even in colthood, they are not disposed to tolerate any indignities. To attempt to teach them anything by force is futile. Man may become the master of a thoroughbred by the use of force, but he becomes master over a creature with a broken spirit, or over a rebellious outlaw. It is only by kindness, by a lifetime friendship between man and beast, that a true champion horse can be produced.

So, from the time the little colts are first turned out to pasture with their mothers, you see men moving among them, hours at a time. To an outsider, it might appear that some men with nothing better to do were frittering away their time, petting colts, romping with them, stroking their coats. But this is a serious business; these are the men who will later prepare these colts for the races, and they are teaching them that man is their friend and can be trusted. So completely do they win



A beautiful thoroughbred takes a morning → walk to limber muscles preparatory to a run



21022



the confidence of the colts, that when the time comes for serious training, little resistance is encountered—not nearly so much as a cow pony gives the first man who tries to ride him.

The training—thoroughbreds are “trained,” not “broken”—is a long and gradual process. Trainers have different methods, but all point to the same end: to calm and utilize the fiery spirit of the horse, rather than let it manifest itself in outlaw devilment. Very early, the little colt will

↑
Full speed ahead! Warmed up by a walk, this thoroughbred now is having the time of his life in a morning run around track

If there is a beach nearby, horses are waded slowly into the water to prepare for exercising injured legs in a way that will not put too much weight on them →

↓
Race horses and other animals are often close companions. This mare will go nowhere unless her good friend the goat is along



have learned to wear his halter, but it requires patience and understanding to get him to accept a bit. Most of the training bits are of rubber, or some other material well padded, so there is a minimum of discomfort.

Next, the colt will have something placed on his back for the first time. It may be a rolled blanket, or it may be a regular saddle, depending on the opinions of the trainer and the temperament of

the horse. It will not be left in place long, but after it has been removed for a few minutes, the trainer will probably put it back again, remove it shortly, then restore it again. This rotation is to keep the horse from becoming alarmed by that strange weight on his back. If the trainer has won his confidence before this, the horse may regard it as a game, and snort and prance a bit, but all in fun.

Now the horse is ready to begin his education in earnest; so far, he has merely been in kindergarten. He receives a harness. A gentle bit is placed in his mouth, a saddle or a roll of blankets is cinched to his back, and long reins are attached. Usually a rope is tied from saddle to bridle, so he will hold his head high without constant pressure from that bit. Everything is done to prevent the horse from becoming alarmed.

Harnessed for the first time, the thoroughbred is guided outside, and walked around a bit; not long the first time, but in longer and longer periods as

The horse is ridden slowly on its first trip through the starting gate and the trainer waits on the other side to quiet any alarm

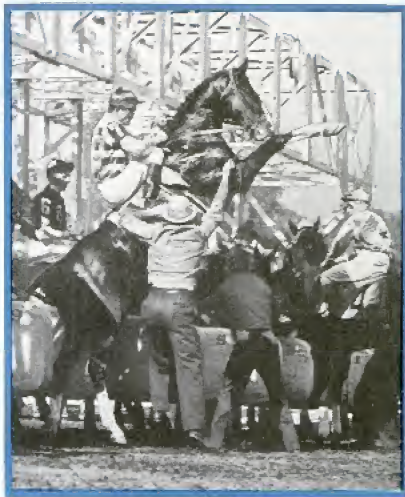
A bit of temperament at the start. The greatest problem of the trainers is to hold this temperament in check and use it to good advantage

he grows accustomed to being driven. The trainer talks constantly in a soothing voice, and soon the horse comes to like these periods. A dog may not like a leash at first, but when he learns that the leash means he is going for a walk, he may fetch it at a word. So these animals come to enjoy being driven in harness. The trainers are gentle but firm. The horses learn that no caprices are allowed, but never are they hurt, intimidated, or alarmed.

After exercise, the thoroughbred is curried, wiped clean, and his mane and tail are combed. His hoofs are cleaned out, and examined for any damage. The horse loves this.

At last comes the crucial time. The horse is to be ridden. With such high-strung creatures, one would expect a real show the first time a man at-

(Continued to page 164)



21355

Collapsible Chair for Army Makes Its Own Crate



Crat. Sarah W. Schuch
600 W. 24th

Compact case, top, contains all the parts necessary to assemble easy-chair for army use, shown at bottom

For use by U. S. Army officers when on maneuvers, a collapsible easy-chair, designed by Chaplain Herbert E. Rieke of the 33rd Pursuit Group at Mitchel Field, N. Y., can be assembled and set up in the field in a few minutes, or quickly dismantled to form a packing box for carrying. A few of them are in use at Mitchel Field. Like a conventional parlor chair, it has leather-covered cushions in seat and back, being made of ordinary pine boards joined with bolts and screws. The hinged back is detachable by sliding hinge pins. The front end of each arm is hinged to a supporting board, and both are removable and fold together for packing. With the arms and

back removed, the rest of the chair becomes a crate into which the cushions, back and arm units may be placed. A large number of the chairs can be transported in a relatively small space.

Guayule Blended With Synthetic Is Equal to Natural Rubber

High resin content of guayule rubber has handicapped its use in American rubber plants, but it may prove a direct benefit if production of synthetic rubber is stepped up as proposed. Tire manufacturing and other rubber processing machinery in this country is set up for natural Hevea rubber which has a normal resin content of about five percent. Synthetic rubber contains no resin, and resin must be added if it is to be processed in the same machines. The native guayule rubber has a resin content of 15 to 18 percent, which must be reduced before processing. By blending the non-resinous synthetic with the highly resinous guayule rubber in the right proportions, a blend of the equivalent of natural East Indies rubber can be obtained.

Padded Bag for Packing a Bottle Guards Against Breakage

Bottles and other small breakable articles can be carried safely in a suitcase by enclosing them in a padded case now on the market. Closed at the top with a slide fastener, the container absorbs the shocks from all kinds of rough handling.



Bottle tucked in padded case is safe from breakage

new York
Vance Inf Co-1170 Broadway

POPULAR MECHANICS
Lamberts, 549 Michigan Chicago

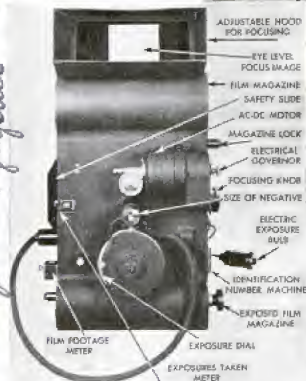
21356

Pushbutton Camera Takes a Picture a Second

Pictures can be taken at the rate of one each second with an electric studio-type camera which has many applications. At one push of the button, the camera performs a complete series of operations, exposing the film, resetting the shutter and advancing film for the next exposure. Ordinarily this takes three seconds, but the action



Above, operating shutter release of electric camera. Arrows at left indicate some of the novel features



may be speeded up to complete the cycle in one second. This automatic feature makes the camera valuable for industrial uses such as photographing an airplane under test in a wind tunnel, since the operator and camera need not be located in the same room. The shutter has an exposure range from $\frac{1}{120}$ to $\frac{1}{2}$ second, plus one to $1\frac{1}{4}$ seconds, and "time." As with the reflex camera, the operator peers down into a hood to see the image reflected from a mirror set at an angle of 45 degrees with the camera lens, and in addition it offers eye-level viewing by swinging a mirror to a 45-degree angle with the ground glass. Both inverted and right-side-up images are shown. Focus adjustment for both po-

sitions is controlled by three knobs. Film rolls may be loaded in daylight, the chamber being large enough to hold a 100-foot roll. Exposed portions of the film may be cut from the unexposed portion before the entire roll has been used. The film is five inches wide, and by means of masks three different dimensions are obtainable: 5-by-7 inches, 4-by-5 inches, and $3\frac{1}{2}$ -by-5 inches. A single loading will provide enough film for 171 negatives of the 5-by-7 size, 300 of the 4-by-5 and 342 of the $3\frac{1}{2}$ -by-5.

Pump Fills Bearing With Grease At Pressure of Handle

Ball bearings and roller bearings can be packed completely with grease in a few minutes by the use of a pumplike lubricator. With a clean bearing placed at the top of the device, a lever presses it down, forcing grease to permeate all parts of the bearing. The unit may be adjusted to handle bearings from $1\frac{1}{2}$ to 7 inches in diameter and holds five pounds of grease.



APRIL, 1942

Ahlberg Bearing Co. 71
300 W. 47th St. New York

License granted by Photographic Technical Corp.

Camera Corp. 271 Madison Ave. New York

21283. Com. Thomas E. Stinson Jr.
3872 Franklin Ave.
Los Angeles

OUR RING of STEEL

UNCLE SAM'S NEW OCEAN BASES



From a tower on a Pacific island base the lookout scans sea and sky

Fighter planes hover protectively over the United States battle fleet

CAN the United States be invaded? It isn't likely, because we are protected by chains of offshore naval and aviation bases on both oceans. No matter from what direction an enemy fleet approaches he would find himself engaged in desperate battle while still far at sea. There is always a chance, of course, that an enemy carrier or two may sneak in from the sea for a hit-and-run air raid.

Some of our offshore bases so far have been liabilities because our defense program, while being rushed, is far from finished. This is the reason for the early Japanese successes in the Pacific.

Today the United States





51233
is completing a crescent of defense that stretches down the Atlantic from Canada to the Caribbean. Eight new bases leased from Great Britain are being strengthened and these will augment present bases on the mainland and on Cuba and Puerto Rico.

In the Pacific, the island of Oahu on which Honolulu is located has become a billion-dollar fortress. That sum has

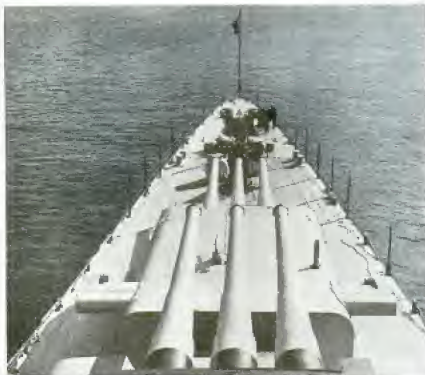
Dive bombers form a mighty "V" as they roar high above an American shore, ready to peel off one by one and plunge toward their target



The map shows the bases to which our Navy's strategic defense lines are anchored. Some of the "stepping stones" across the Pacific have been lost



— With this huge height finder, spotters for U. S. anti-aircraft batteries determine the range of enemy airplanes and furnish data to the gunners



deadly triangle through which an enemy would have to storm his way. Honolulu is 2,400 miles offshore, but that is less than a day's flight for an airplane.

Under as much secrecy as possible, similar defensive activity is being rushed in Alaska. Men in uniform swarm the streets of Anchorage, Fairbanks, and other northern cities. Millions of dollars are being spent for new Army and Navy bases, new sub-

← Looking over the powerful forward battery of a heavy cruiser

This giant searchlight can spot enemy aircraft miles in the sky

built an impregnable fort, containing our strongest airplane defense base, a great concentration of troops, a multitude of anti-aircraft guns and complete naval facilities. Vast stores of ammunition lie in secret underground caches. Military roads have been built to many parts of the 604-square-mile island, some leading to 16-inch gun and heavy howitzer emplacements in the mountains.

Pearl Harbor has the world's largest floating drydock. The harbor is a base for our high seas submarines that have a cruising radius of 15,000 miles. There are facilities for rapidly provisioning and repairing the Navy's scouting and battle fleets. The Hawaiian Islands are not self-supporting and so food has been stored away. Long ago plans were laid for taking over thousands of acres now in pineapples and sugar and planting other food crops.

The reason for the military emphasis on Oahu is that the island commands and protects the whole west coast. Together with Alaska and Panama it forms an invisible but



Its flight deck crowded with planes, the U. S. carrier "Enterprise" rides at anchor in port

LT232

marine stations and tremendous bomber bases up and down the coast. More money is being spent in the defense of Fairbanks alone than was spent in buying all of Alaska in 1867. Naval bases and "listening posts" are being prepared far out in the Aleutian chain. A new Army Air Force cold weather experiment station has been opened to study the special adjustments that are necessary for bomb sights, machine guns, and airplane controls because of the intense cold. It is impossible to build enough heated hangars for the tremendous aerial fleet that is being sent north, so special methods are being developed for warming the engines and thawing out the controls of planes that must be parked out in the weather.

The Air Forces were told that it was impossible to do any building during the winter months, but construction of airports and buildings is keeping pace with a fast schedule nevertheless. All building materials except sand, gravel, and lumber have to be imported from the states. Spongy tundra, some of it permanently frozen, is being thawed out and scraped away so that permanent landing surfaces may be laid out.

Not only does Alaska guard our northwestern flank, serving as an anchor for the Alaska-Hawaii-

(Continued to page 187)



Fighters from an aircraft carrier skim over the sea wing to wing in a formation that testifies to their pilots' skill



Sailors of the battle fleet are trained to fight in gas masks

A trans-Pacific flying boat refuels at a tiny island outpost



L1413

Flashlight for Men in Camp Has Mirror for Shaving

Use also Complete 1.75
pend



Camp light with mirror in cover handy for shaving

Offering a wide range of uses to men in camp, a flashlight housed in a durable metal case finished in khaki is switched on by opening the lens cover which has a mirrored back. Opened partly, the lid deflects the light at any angle, and when raised all the way it is a handy shaving mirror. An "on-off" spring switch serves as a key for flashing dot-dash code signals. The lamp also supplies light for writing, reading, emergency repairs, first-aid and nonglare illumination during blackout. It has a shatterproof plastic lens, and its flat sides enable it to stand anywhere.

Self-Cleaning File Sheds Shavings Between Its Cutting Edges

Troublesome clogging of file teeth is eliminated in a patented tool containing scores of parallel cutting blades with narrow slots between them through which the chips may pass freely. A flick of the wrist



Fillings pass through spaces between crosswise blades

John Paneroy
Melbourne, Australia

or tap of the tool rids it of accumulated material. It is especially useful on metals such as aluminum, magnesium, lead, zinc and copper. The new file also cuts plastics, fiber and hardwood without loading or clogging. A tensioner, consisting of two rods and a turnbuckle, provides a means for operating the file slightly convex or concave, as well as flat.

in 54

Way to Make a Dynamite Shell Claimed by Inventor

Efforts of inventors to develop a dynamite-loaded artillery shell have always been foiled by the sensitivity of the explosive, which would not withstand the shock of its abrupt discharge. Now an Australian has patented a double shell with dynamite in its inner container. Fired from a rifled gun or howitzer, the shell spins, and this forces some of the nitroglycerin in the dynamite to the surface of the inert absorbent of the dynamite, where the slightest impact will explode it.

L1402

Cleaning Brush Rotates in Bottle When Handle Is Squeezed



Bottle-cleaning brush is rotated by squeezing handle

Bottles can be cleaned easily with a mechanically rotated brush now available. Simply squeezing together two parts of the handle imparts a quick rotation to the brush, and releasing the grip permits a

spring to spin it back in the opposite direction. This action creates a scouring motion for cleaning the interiors of bottles, vases, jars, pitchers and tubes. A small chuck at the base of the handle can be unscrewed and other brushes inserted. The complete set includes a hooked brush and two straight bottle brushes of different sizes.

Luminous Paint Used in Blackout Makes Objects Visible

Blackouts lose some of their gloom and inconvenience if objects are coated with luminous paint that becomes visible in the dark in the presence of "black light." The black light, consisting of ultraviolet rays, is invisible to the eye, but has properties that cause certain chemicals to glow. If black-light lamps are used indoors and outdoors in cities during blackouts, according to experts of the Westinghouse Lamp Division, it would be possible to apply the special paint to small objects such as hats, gloves, purses and canes, thus making them easily seen at short range. This would help avoid collisions on the street without supplying enough light to aid enemy air raiders. Painting objects in the home would serve as a guide in getting around while the lights are out.



Paint makes gloves, hat and purse glow in the dark

Spray Built Into Washer Rinses the Clothes



Wringers and rinsing arrangement, shown at bottom, are built into upper chamber of washing machine

Separate tub-rinsing of clothes after washing is unnecessary when using an automatic electric washer combining a wringer unit and spray-rinsing fixtures in the upper compartment. After washing is completed, the clothes feed between an initial pair of rollers at the front of the machine to press out the soapy water. Upon leaving these rollers they meet a penetrating spray of clear water and immediately dip downward into water kept clean of any suds by a constant overflow. Emerging therefrom the clothes are subjected to a final spray-rinse before passing between the second set of damp-drying pressure rolls. At the end of their trip the clothes are deposited in a basket on the floor behind the washer. The machine may be installed permanently in the laundry with pipe connections to hot and cold water and the drain, or operated as a portable unit.

APRIL, 1942

77

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21360. Press Association
50 Rockefeller Plaza, New York

WATCHDOGS of the SEA



Helping to guard American shores and shipping are the U. S. Navy's destroyers, deadly foe of the submarine. Above, an action photo showing the torpedo crew loading a "fin fish" into the tube. The destroyer can strike swiftly in a naval engagement, sweeping in to fire its torpedoes at larger vessels—battleships, cruisers and aircraft carriers. Right, torpedomen in turret atop destroyer's quadruple tubes





Crew manning secondary or emergency controls of destroyer. These controls are duplicates of those in the pilot house and would be manned in case the pilot house were damaged



Always ready for anything—that's the destroyer crew, which must be prepared to deal with enemies on the sea, above the sea and under the sea. Here is a machine-gun crew in steel helmets and gas masks

Invaluable watchdogs of the sea, the destroyers have an important mission in the protection of merchant vessels. While accompanying a group of these ships, the destroyer scurries around like a sheep dog, keeping the stragglers in line and maintaining a sharp eye for the wolves of the sea—the submarines. Upon sighting the telltale wake of a periscope, the destroyer speeds to the scene and drops depth charges. Right, a striking photo of a destroyer column. Below, American destroyer proceeding at high speed

Official U. S. Navy photos



21293.

Roll of Paper in Table Top Used as Tablecloth



Clean table covering drawn quickly from paper roll

Table covering can be changed in ten seconds, without removing small dishes or salt and pepper shakers, on a patented table-top under which a roll of damask-like paper is installed. Frames at two ends of the table are flipped up when a clean supply of paper is to be drawn across. The second frame has a sharp edge for convenience in tearing off the soiled portion. It also serves to stop the dishes as they slide across with the paper. After the dishes have been rearranged the table is ready for service.

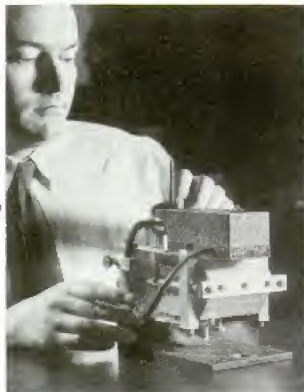
Pitch Proves Best Extinguisher For Magnesium Bombs

Granulated or flaked pitch is now regarded by the U. S. Bureau of Mines as the best extinguisher for magnesium incendiary bombs. Spread over the burning bomb, the layer of hard coal-tar pitch will melt at about 300 degrees Fahrenheit and form an airtight blanket that quickly smothers the flame. Before attacking a bomb, a minute's wait is advisable to let the thermit burn itself out. Then, if the bomb is on concrete or metal, use a long-

handled shovel to spread—not throw—a layer of pitch on it, following with another layer if a short flame persists. Then it can be allowed to cool for 10 minutes, even if smoking, before removing in a bucket. If the bomb is on a wood floor, a layer of pitch should first be spread on to stop heat and glare, then spread pitch on the floor nearby, rake the bomb into it and cover the mass with more pitch. Protective clothing and goggles should be worn, since some incendiary bombs contain mild explosive charges. The Bureau of Mines recommends keeping 25- or 50-pound lots of pitch in boxes or bags with a shovel nearby.

Large Rotors Balanced Quickly With Aid of "Seismograph"

In balancing the rotors of large machines that turn slower than 600 times a minute, a handy "seismograph" enables the machinist to find the exact spots of heavy or light regions. With this information at hand, it usually is simple to shave off enough metal at the right places to eliminate vibrations and bring the machine into balance. The balancer is said to be capable of locating vibrations measuring as small as 1/1000 inch in a machine rotating only 100 times a minute. It has been used successfully in determining the weight balance of a 40,000 horsepower motor.



"Seismograph" reveals light and heavy spots in rotor

Science Service
1/16/42
Table Top, Inc. 305 E 46 St. N.Y.
New York City

Mr. A. H. Sayre
Director.

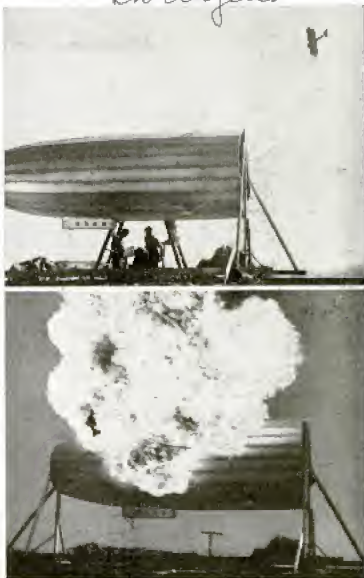
Photo by Pa
B. B.
Westinghouse Electric Corp.

21357 Cmt. Pavell. Clar
Box 5403, Metro Station
Los Angeles

Models Stage Crackup of Plane and Dirigible

How they used miniatures in setting the stage for realistic movies of an airplane and dirigible crash in midair was explained recently by special-effects men. A tiny airplane was released from a 40-foot tower so it would slide down a pair of thin wires rigged up for the purpose, smashing into a model dirigible at the end of the run. On its downward trip the plane struck a switch in its path, thus exploding 12 ounces of flash and black powder and one and one-half gallons of gasoline with which the dirigible was loaded. Flames shot thirty feet into the air and burning fragments from the two models scattered through the air. To give the dirigible the appearance of motion through clouds during the filming of the early scenes before the actual crash, titanium tetrachloride, or "liquid smoke," was blown in front of the camera. The dirigible model was covered with canvas and painted a silver color.

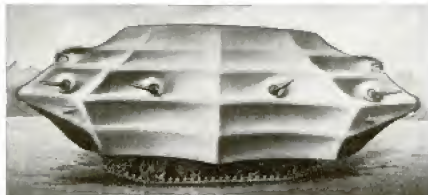
Special-effects men, top, load dirigible with explosives while tiny plane is pulled up the wires. Right, rearing flames leap skyward as soon as plane dives into dirigible



Sloping Walls of New Army Tank Would Deflect Shells

Differing radically in appearance from any other war tank, a mobile fortress resembling a two-headed frog has been designed by Cleveland W. Cole, of Los Angeles, Calif., for submission to the War

Department. The tank would have sharply sloping sides and ends made of arc-welded steel castings, presenting a difficult target for attackers since their shells would be deflected. Eight main guns would protrude through "eyeball" sockets capable of turning in any direction. The inventor also asserts he has developed an instrument which will permit the ejection of nitroglycerin from army tanks. Heretofore this has not been possible because the powerful explosive would blow up the tank itself in the process.



Latest tank has sloping sides which make poor target for effective hit

Air raid shelter ref: - V. Nelson 727 Sonoma Ave
Glendale Calif

21397
Cmt: Thomas L. Stevenson
3872 Franklin Ave. Los Angeles

WHAT TO DO in a BLACKOUT



Air horns mounted on top of building as air-raid warning device. These horns have a range up to 12 miles

In southern California traffic lights have been painted black except for thin cross through which signal may be seen. There's a cross on each glass
↓



CALIFORNIA was "on the yellow"—enemy airplanes had been reported by watch stations of the aircraft warning service and the yellow alert signal had been flashed to every community.

Then in the interceptor headquarters in Los Angeles an Army officer snapped off the yellow light and flashed on the blue. Almost immediately, police radio stations were notifying their prowling cars: "Air-raid message, all cars. Blue light. Blackout at once."

Air horns and sirens began howling the blackout message. Section by section, street light switches were pulled. Broadcast stations went off the air. Advertising signs winked out. Householders doused their lights. Air raid wardens sprang to duty and stopped all traffic, ordering lights turned off. With few exceptions, all of southern California and most of the Pacific southwest was black.

The air raid didn't come, that time, but the test showed that Los Angeles, with its surrounding communities can hide in darkness faster than many European cities. That's because many preparations had been

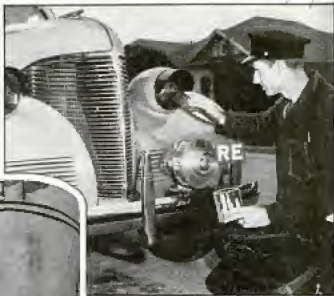
Fire dispatcher at Long Beach, Calif., with finger on emergency switch that flashes air-raid alarm to outlying fire stations which sound air-raid horns



21397



Air-raid warden with blue-lens flashlight and white arm band demonstrates how he would direct motorist to a parking place in a blackout



Emergency fire auto with hooded lights. Fireman is painting lenses blue to reduce visibility from above



Interior of a bomb shelter designed for underground location. It would protect occupants from all except a direct hit

21397



Air-raid siren being operated by fireman who has gas mask handy

Firemen, right, demonstrating how incendiary bomb may be combatted with dry sand by banking the sand around the bomb to prevent spread of flames. Another way to fight such bombs is with fine water spray

Roofing paper on window screen is aid in preparing a blackout room



made ahead of time. Airplane plants were blacked out with window paint so production could continue night and day. Airports, defense factories, bridges, tunnels and power stations were under guards. Automobiles and airplanes patrolled power lines and aqueducts.

Citrus ranchers whose heavily smoking smudge pots had been deplored in the past were told that their smoke blanket may help keep enemy bombers from locating their targets. Fifteen thousand auxiliary police were enrolled in Los Angeles to serve as air-raid wardens. Fire department auxiliaries were detailed as fire watchers and were trained in clearing debris, handling incendiaries, and in poison gas protection.

Traffic lights were hooded from above and their normal brilliance was reduced by

black paint that left only a thin cross of clear glass. Headlights of emergency cars were hooded and sprayed with dark blue paint. Air horns with their own supplies of compressed air were installed as air-raid warning systems with arrangements for operating them even if ordinary electrical and communication lines fail. Construction of air-raid shelters was begun. Civilians were moved from homes adjacent to fortified areas, and forest areas were closed as a precaution against fires. Passenger and freight trains operated with lights dimmed.

At the harbor, ship traffic was halted after dark and an anti-submarine net was raised across the entrance to prevent passage from dusk to dawn. Merchant ships worked cargo at their piers in the daytime and moved to anchorages in the outer

21397

21380

harbor over night. All these precautions with varying details have been duplicated at San Diego, San Francisco, Seattle, and the other west-coast defense areas.

If you live in any area that might be visited by enemy bombers, there are a number of things that you should do at once without waiting for the emergency to occur. First, familiarize yourself with the local blackout, air raid, and all clear signals and regulations. Those vary in different communities. It is a good idea to store five gallons or more of fresh water in sterile glass containers against a possible interruption of the water supply, changing the water every few weeks.

Lay in a supply of candles and fresh flashlight cells. You might need them if your domestic electricity is cut off or fails. Next, get one room ready as a blackout room inside of which you can use lights after dark when a blackout has been ordered. The kitchen is often best for this because light is needed for preparing meals. The room must be arranged so no light escapes outside. A sandwich of newspapers and blankets tacked across each window will keep all the light inside. Special shadowproof blinds will do the same if you seal their edges to the window openings. Plywood panels cut to fit the windows also prevent leaks. Window screens may be covered with black roofing paper for the same effect. If the door to your blackout room is apt to leak light outside when opened, turn out the lights when using the door.

Next, if no public air-raid shelter is available nearby, decide on the safest room in the house and be prepared to remain in it when a raid is occurring. A lower room is safer than one on an upper floor, and one in the middle of the house that is protected by several thicknesses of walls is safer than an exterior room. Such a choice should provide excellent protection from fragments and flying splinters, which is about all the security that most air raid shelters afford. All fires in a house should be extinguished at the first warning.

Remember, those who allow themselves to become panicky are in the greatest danger. No matter what sort of shelter you have, it is safest to remain there. If you are caught in the open, lie down.

There are several ways to deal with incendiary bombs. Fill a barrel or several

(Continued to page 167)

Dime-in-the-Slot Typewriter Gives 30-Minute Service



Customer drops a dime in the slot to type 30 minutes

Thirty minutes' use of a typewriter is sold for a dime with a coin-operated machine for public use. If, after the expiration of a half hour, more time is needed to finish the typewriting job, it would be necessary to deposit another dime.

21382

Insecticide Can Fits on Sprayer By Means of Built-In Lock

Deterioration of a powerful insecticide now on the market is prevented by packing it in a hermetically sealed can that becomes part of the sprayer. The can is attached to the sprayer by piercing it with a section of the sprayer and turning a locking device built into the can. The sprayer is of the continuous pressure type.



Attaching the sprayer to sealed can of insecticide

21399

Super Siren Gives Warning Heard Two Miles Away



Four-horsepower siren spreads alarm in 2-mile radius

Super sirens that can be spotted in the most advantageous positions for spreading "air raid alert" alarms have been designed for installation in New York City. Capable of projecting its sound a distance of two miles, the siren is 36 inches high and operates on four horsepower.

21326

Anti-Skid Sleeve Worn Over Shoe Prevents Slipping on Ice

Protection against slipping when pavements are icy is offered women in the form of elastic anti-skid sleeves which may be



Nonslip boot is pulled over the shoe like a sleeve

L. K. F. Schuch
Lansville, Neb.

pulled over the shoes in a jiffy, even fitting over rubbers. When folded they are small enough for carrying in a purse. On the foot, a slide fastener closes the sleeve at the top and an elastic fabric band snaps over the back of the shoe. Instead of having metal projections, the sleeves are made of tough, ribbed cotton or rubberized fabric, so they may be put on in the house without risk of marring floors.

21254

Electric Photo-Marking Pencil Writes With Metal Foil

Quick identification of negatives is made possible by writing names, dates or other data on them with an electric marking pencil. Writing is almost as easy as with an ordinary pencil. A piece of metallic foil cut from a roll is placed over the surface, and the point of the pencil, heated by elec-



Negative (inset) was printed with electric pencil

tricity, writes through the foil on the negative. You can make inscriptions in gold, silver, or other color. The pencil also will write on leather and other materials, so it is possible to letter objects such as post cards, cameras or photographic prints.

21394

Sonic Finders Plot the Course Of Planes Hidden in Clouds

Good gunnery of German ground defenses against airplanes has been attributed to the use of a new type sonic or

may all
23rd
1941

acoustical locator installed in a network of stations throughout western Germany, the Low Countries and occupied France. The instruments reveal the altitude, direction and speed of planes even when they are hidden by clouds, and this information is used in directing anti-aircraft guns. However, instead of attempting to hit individual planes, the gunners lay a "curtain" of exploding shells two to four thousand feet in height and across the path of the aircraft at their approximate altitude. If a plane flies through the curtain barrage it has little chance of escaping damage. Groups of locators and gun crews dot the countryside at intervals of 20 to 30 miles, it is said, and information concerning the courses, speeds and altitudes of raiders is telephoned to central points where it is digested and forwarded to anti-aircraft batteries. German technicians say that when operating against a plane flying at 28,000 feet the sonic locators are subject to errors of less than 40 inches.

21273

Cardboard City Bombed To Break Ground

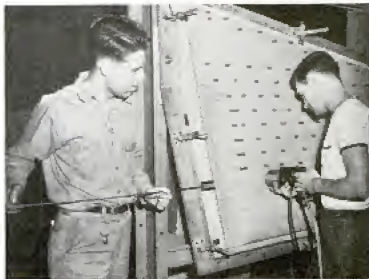
Ground breaking ceremonies took on the nature of a bombing raid in celebrating the opening of the plant site for Missouri Ordnance Works at Louisiana, Mo. A cardboard city covering more than 1,500 square feet was blasted to destruction, thus substituting gunfire and dynamite for the conventional formalities usually performed with a spade.



Cardboard buildings being blown up in breaking ground for factory site

APRIL, 1942

Magnetic Hammer Holds Rivets While It Pounds Them



Magnetic hammer (bottom) does away with helper shown at top

Holding rivets in place on large plates with a bucking bar, while the riveter plays a tattoo on them with the hammer, required the service of a riveter's helper until the recent introduction of a combination electro-magnet and riveting machine. It is said the tool will speed up work about 50 percent. A pull of more than 100 pounds exerted by the magnet now holds the bucking bar against the rivet as the crimp is set upon it. The bar follows the riveting machine as the operator moves it about.

The magnet is cylindrical with a hollow center through which the rivet hammer works. The unit weighs 11½ pounds.

Ⓢ The spectrograph is so sensitive that it will detect lead in the blood of a person who has slept in a room which has just been painted.

Launch news 87
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Bureau. 911
Western

J. W. Spender Co. 5700 Washington

Seattle, Wash

21398 Leggett

NOW YOU SEE IT--OR DO YOU?



Above is an example of manner in which airplane may be concealed from aerial observers. In circle is plane, beneath it is sugar cane field in Hawaii. U. S. Army engineers find dark colors generally are best means of camouflage

†
fooling enemy observers is the task of camouflage engineers who have intensified their efforts since the war began. Here are models of oil tanks used by a Kansas City institute in the study of industrial camouflage problems. Note reduced visibility of tanks covered with various materials. This photo simulates view that an aerial observer would have of full-size tanks



†
Use of foliage for concealment is standard practice. Here two members of medical corps creep along ground bearing foliage-covered stretcher on which lies a casualty. This type of camouflage is very successful in wooded areas



Smoke screens, too, are useful in concealing the movement of army vehicles and navy vessels since they obstruct vision and make direct hits a matter of luck. In general, the latest idea in camouflaging industrial plants is to break up lines of buildings and terrain to confuse bombardiers in enemy raiding planes. Bombing planes travel at high speed and if the bombardier hesitates, his plane must swing around and repeat its run over the target. This gives defending planes and guns time to prepare a hot reception for the raider

21398



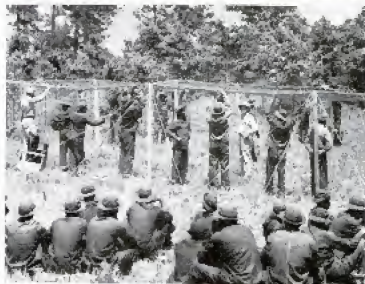
Soldier camouflaged with twigs and leaves hurling explosive of "enemy" pillbox in maneuvers at Fort Belvoir, Va., where camouflage engineers have devised many ways to fool enemy eyes

Photo at right shows effectiveness of camouflage. Soldier at left is covered with netting, the other is not. One you see, the other you probably would not if they were viewed from a distance

Below, installing framework to support net and foliage which would help conceal a gun. Bottom, right, crew of a tank camouflaging their vehicle. Generally, camouflage is divided into four types: reduction of visibility, complete concealment, changing the apparent identity of the object and the use of decoy targets. Camouflage combines knowledge of many fields, including design, construction, art and engineering



Fort Ord, Calif.



APRIL, 1942

Two Armed Forces
Fort Belvoir
Ira.

21339

Metal Drum "Can Opener" Cuts Edges Smoothly



Opener for metal drums operates like a can opener

Metal drums can be opened quickly and safely with a cutter operated like a wall-type can opener, doing away with the hammer-and-chisel method. It leaves no jagged edges and is adjustable to fit straight-chime drums up to 35 inches high.

Chair Built on Frame of Sander Seats Operator at Work

Greater comfort and a higher degree of efficiency are claimed for a belt sander



Seat gives steadiness and comfort while sanding

having a built-in easy-chair in which the operator sits at his work. A transparent, nonbreakable shield, adjustable to any angle from horizontal to vertical, protects him from dust and possible belt breakage, and a steady flow of air blows dust away from the work to the far end of the machine where it is gathered into a suction chamber. The machine uses belts of any width up to 1½ inches, a ¾-inch belt being considered best for general work. For inner-contour sanding, the belt may be threaded through openings.

21322

Glass-Top Electric Corn Popper Reveals Bursting Kernels

More interest in corn-popping, especially for children, is offered in an electric popper with glass top which gives a full view of the exploding kernels. To prepare the popper, a measured amount of any good cooking oil is poured into the cham-



White popped corn can be seen through the glass top. A quantity of popcorn added and the cord plugged into an outlet. Popping begins as the oil becomes heated by the electric current. Since the oil sets up a circulating motion, it is not necessary to shake the popper. When popping ceases, the plug should be withdrawn immediately, the lid removed and the popped corn poured out.

Write to the firms listed in the Where-to-Buy-It index, to learn more about products described in this magazine. Say You Saw It in Popular Mechanics.

21354 Cont. Rene W. Leonhardt
340 Riverside Drive
Spies Armed With Cameras Hunt Style Secrets



Since the capital of fashions shifted from Paris to New York and Hollywood, spies of the style world have beset these American centers. Armed with hidden cameras or with paper and pencil, they attend designers' fashion shows and obtain pictures of original models. Ankle camera at top is one method



To protect their ideas, the style originators issue invitations to fashion shows with great caution and place spotters among the audience to watch for cameras or persons making sketches. Models wearing new creations (top) are covered with sheets to conceal gowns as they walk from their dressing room to the display salon



Posing as an ordinary spectator, a fashion spy with a camera concealed in a handbag can snap a picture of a dress worth copying while her neighbors are engrossed in the exhibits. Cameras have even been built in the double sole of a shoe, with release buttons in the trousers' pocket to open the lens by raising a patch of leather and make up to 24 exposures. Style designers however, are alert for these tricks and usually seize the films

NIGHT HAWKS of the AIR CORPS



Flight officer in plane parked near runway gives radio orders to planes making night landings

for familiarization flights.

From the ground you wonder how the planes can possibly avoid collisions. In all directions and on different orbits red and green navigation lights are racing against the stars. Not much more than half a minute apart planes swoop down for landings, taxi back to the end of the runway, and roar off again into the dark. It seems impossible for the students to keep their heads in all this confusion.

Then the control officer tells you that the planes are all on courses that keep them safely separated.

The air over the field is divided into four quadrants. Four students are assigned to fly in each quadrant at altitudes 1,000 feet apart. The flyers are called in one at a time for landings by radio from the control tower or from the control plane parked near the end of the runway. Sometimes they land by the light of the field

NIGHT fighting against fleets of bombers is a recent development of aerial warfare, so today Uncle Sam's student pilots are getting a thorough coaching in night maneuvers.

During a busy night at Mather Field, Sacramento, as well as at other advanced training bases, 16 students at a time go up

Air force mechanic overhauls engine of a training plane

Sighting with drift indicator in flying classroom



21127 Ryan 87.21-0-22



floodlights; other times the field is kept dark and the students use their wing lights. To simulate the radio silence of an actual war operation the control officer sometimes snaps off his radio transmitter and signals the planes with a light gun that throws a beam strong enough to attract a pilot's attention five or six miles away. The students receive balanced diets selected to improve their night vision.

Two years ago the Army was training a few hundred students a year. This program has been stepped up to 30,000 students a year with provision for still further expansion. Prospective students who have not studied two years at college may qualify by passing an examination instead. Scores of new training centers are springing up, particularly in the south, where the weather permits all-year training.

Night flying is one activity that is emphasized today. Precision formation flying is an-

Aviation cadets are learning to fly in these training planes

The week's worst blunder wins a Randolph Field pilot this sign





With the skin of its fuselage stripped away, construction and maze of controls of a training plane are exposed. Familiarity with these is an essential part of training



In the open, a student works on engine mounting of a trainer

Two-engined training plane preparing for a night take off



other. Formation flying is safer than it used to be in spite of much higher speeds because the speed range and acceleration of the new and larger motors allows more positive control. The rear planes of a formation used to fly at slightly higher altitudes than the leaders as a safety factor; now all the pilots in a formation maintain the same level because in the new planes downward vision is restricted. Formations are looser now and the pilots keep five yards or more between wing tips instead of flying so close that the wing tips almost touch. This is done purposely as a training measure because the greater distances are harder to judge and hence the pilots learn more exact control.

The modern trainers are as fast as the best combat planes of four or five years ago and the students take off and land in formation at speeds that were considered dangerous not many years in the past. Improved landing gear and improved control features make this possible.

If you should be accepted by the Air Forces for training, your first five weeks would be spent in a replacement center where you will be taught infantry drill, military law and courtesy, and will begin your studies to become a flying officer. From there you go to a primary training school, operated by civilians under Air Forces supervision, for ten weeks of ground school and flight training. Sometime during the first two or three weeks of this period you will solo and then you will begin elementary maneuvers and acrobatics.

Ten more weeks are spent at basic school, at a different field, where ground classes are continued and where you must solo all over again in a faster, heavier airplane. By now you are making night flights and getting the feel of more intricate acrobatics. You participate in cross country hops and learn more about radio, gunnery, navigation, and meteorology.

Graduates from this stage of in-

11127

21346

struction go on to advanced school where once again they first fly with an instructor and finally solo in faster and more advanced aircraft that are equipped with retractable wheels, flaps, and a supercharged engine. By now the students have become capable pilots and they spend their time in acquiring the precise touch needed for formation work and the maneuvers of aerial warfare.

The training is fast and thorough and the students are on their toes all the time. Honest mistakes are overlooked but mistakes caused by carelessness are handled by the student's fellow pilots. If a student on a cross country flight gets mixed up in his navigation and lands at the wrong field, he won't forget it in a hurry. At some fields such a mistake brings the student the uncoveted honor of possession of a humorous trophy that he has to keep until another student "wins" it away with another mistake. Taxiing into a hangar wall, landing on one wheel, and similar careless actions earn him a huge tin medal or membership in the local chapter of the "Stupid Pilots' Club."

The four stages of training are comparable to the four years of education in a university. About 30 percent of the students fail to graduate, most of these being weeded out in the preparatory period at the replacement centers. Instruction is exactly the same at all schools of the same grade with the result that students from different parts of the country who are brought together are able to team up and fly in formation just as if they had been practicing as a group for weeks. Graduates of the training course are commissioned as second lieutenants in the Army Air Forces reserve and go on from there to active duty, being assigned to one of such specialized branches of the air force as pursuit or bombardment.

There are other jobs in the air force beside the one of handling an airplane's controls. Specially trained navigators are needed for long flights on large aircraft. Navigation is a specialized training available to university students who have studied mathematics. The 15-week navigation course at such schools as Mather Field leads to a commission. In school they specialize in piloting, radio aids, celestial navigation, and dead reckoning. Learning to fly an airplane is no part of the course

(Continued to page 168)

APRIL, 1942

Convertible Play Table for Child Can Be Made Into Cart



Parts (circle) make either wagon or table (bottom)

Offering several uses in the playroom, a juvenile table that has a good solid playing surface and includes two strong stools to sit on, can be converted quickly into a cart or a toy-holding bin. To make a strong wagon the legs are removed from the table, axles are inserted and four colored wheels mounted on them. The stools become side supports for the wagon so it can be used as a bin for storing many small toys.

21320

Brush for Reaching High Places Fits Vacuum-Cleaner Nozzle

Tops of picture moldings, window frames, doors, shelves and similar hard-to-reach surfaces are dusted more easily with a brush that fits the long-handled nozzle of a vacuum cleaner. Designed to ride smoothly over upper ledges, the attachment is curved to provide



the correct angle for getting at elevated places. It is also handy in cleaning bed-springs and under the edges of furniture.

Universal Vacuum Cleaner Co.
Copyrighted material

Hugh B. Renney
merchandise mart Chicago
1416
merchandise mart Chicago

21349

Portable Chute for Tall Buildings Saves Fire-Trapped Persons



Canvas chute, set up quickly between upper window and the ground, provides safe means of descent from burning building

Instead of jumping into a net from burning buildings, people trapped in fires at San Diego, Calif., hereafter will slide to safety. Fire officials of that city have introduced a canvas trough, called an "evacuator," which can be set up quickly to form a chute between an upper window and the ground.

Color Film for Ordinary Camera To Be Made in Six Sizes

Anyone with an ordinary roll-film camera—even a box camera—will be able to obtain natural-color photographs by using a new color film announced by Eastman Kodak Company. The film, a completely new development called Kodacolor, will be available in six standard sizes. Unlike Kodachrome, however, it will not be a natural-color transparency, but will record colors in reverse—its colors complementary to those in the actual subject. A red sweater, for example, would be a blue-green in the negative, while light areas

would be dark, and the dark areas, light. The negatives will be used to make natural-color prints which can be handled and viewed like a black-and-white print, or placed in an album. As in the case of color transparencies, the film must be returned to the manufacturer for processing, and the photographer will receive, in addition to the negatives, a full set of color prints, the total cost for each picture averaging about 70 cents. These color pictures overcome the limitations of the transparencies which, because of their scant dimensions, fit a relatively small number of cameras and need a projector to be shown properly.

Barbless Plastic Grater Does Not Injure Hand

Cheese can be grated down to the last morsel without injuring the fingers if you use a new plastic grater that has no sharp barbs. Instead it consists of a series of criss-cross bars on which any kind of food may be grated. Inverted, it may be used for dicing vegetables. The plastic is unbreakable and also easy to clean.



Grater without sharp points will not scratch fingers

Scenic Service
Dec. 15, 1941.

*Urb. Vry. & Traged. & Associates
Merchandise Dept. Chicago*

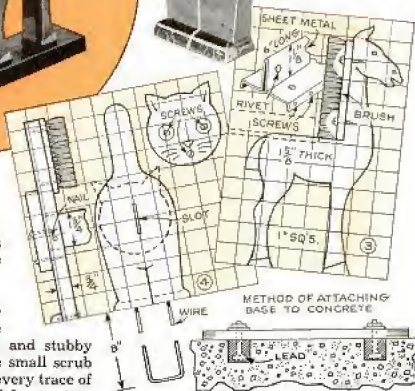
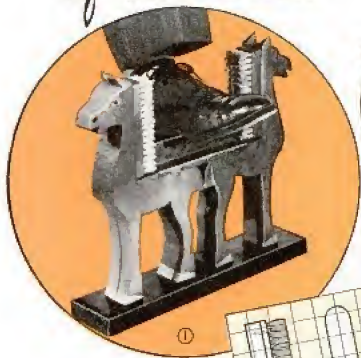
Procter & Gamble



The CRAFTSMAN

FOOT SCRAPERS

of distinction

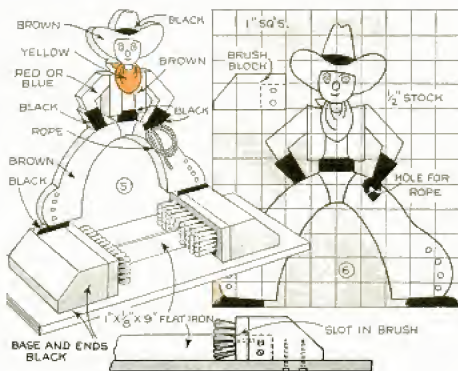


By Bess Livings

Cut from wood or cast in metal, these new, artistic designs are doubly practical because of added side brushes

THESE foot scrapers will do an extra clean job as the bushy tails of the twin cats and stubby manes of the twin horses are small scrub brushes that aid in removing every trace of mud. If made of durable wood, kept painted and varnished, these foot scrapers will withstand outdoor use. Squared drawings from which you can make full-size patterns of the animals are given in Figs. 3 and 4. Some carving must be done on the horses after you have cut them out. To do this, first taper the heads to about 1 in. at

the nose, indicate the eyes and nostrils, and shape the ears by cutting away the wood between them. Then run a fine V-groove up the front legs and around the tail as in Fig. 1, and finish by rounding all edges of the figure with sandpaper. The scraper part is bent from a piece of 22-ga.



To make the scraper shown in Figs. 2 and 4, cut duplicate parts of the body and head patterns from $\frac{3}{4}$ -in. stock. The scraper iron is held in the slotted bodies with a nail which you drive in from the edge to meet a hole in each end of the iron. Then, with gummed notebook reinforcements applied for the eyes, you drill holes and drive screws to form the pupils and the mouth. These screws also serve to fasten the heads to the

sheet metal as indicated in Fig. 3, after which you fasten it to the horses' backs, between the brushes, with screws through the top and sides. Complete the scraper by fastening it to a 3 by 14-in. base, driving the screws up into the hoofs. The detail below Fig. 3 shows a simple method of bolting the scraper to a cement step or walk. Holes are made in the concrete and lead is poured around the bolt heads.

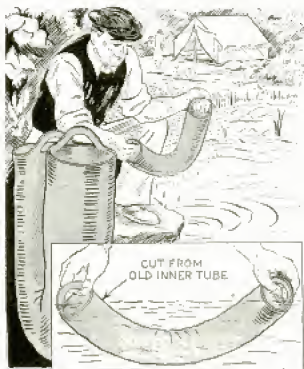
bodies. Small shoe brushes will do nicely for the tails. A wire yoke forced into the wood as in Fig. 4 is one way of anchoring the scraper to the ground. Another way is to fasten a pointed stake to the back of each cat. In the case of the cowboy scraper detailed in Figs. 5 and 6, the wood backs of the brushes are slotted to set over the scraper iron, the figure being attached to the base with a screw through each foot.

Emergency Water Bucket Made From Old Inner Tube

If you need a bucket at camp or to carry in your car and there is none at hand, one can be improvised quickly from an old inner tube. Just cut out a section of the desired length, forming handles at the ends as indicated. If the tube is not damaged too badly, cut out the valve section and patch the holes in the remaining part. This will provide a large container that takes practically no storage space in the car.

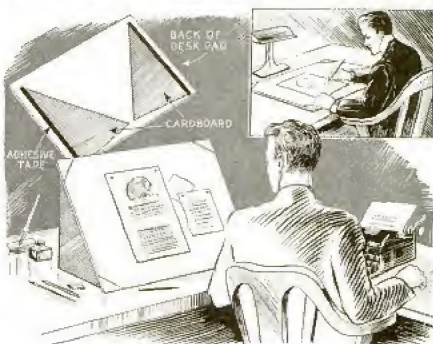
How to Flatten Curled Linoleum

When the edge or corner of a linoleum rug bulges or curls up it can be flattened by this simple method: Place a hot-water bottle filled with hot water over the bulged or curled edge. When the linoleum is thoroughly warm, remove the bottle and place a large book or flat weight over the spot until it has cooled. A stubborn spot will usually respond to this treatment.



Desk Pad Holds Work for Reading or Typing

If you work at a desk and occasionally need a support to hold papers, books and drawings for studying, or work to be typed, you can use your desk pad for the purpose. This makes it unnecessary to have at hand a regular support, which must be stored out of sight after you have finished with it each time. To convert the pad for a holder, just hinge pieces of heavy triangular cardboard near opposite edges of it to serve as supports or legs as shown. Adhesive or cellulose tape will do for the hinges. The angle at which the lower edges of the legs are cut will determine the angle at which the pad is supported. When



not in use, the cardboard pieces are folded under the pad out of the way so that it can lie flat on the desk.

Temporary Mounting for Pipe Vise in Basement of Home

If you do your own plumbing work, here is a handy way of mounting the pipe vise

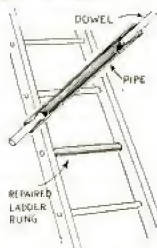
so that it is rigid, yet can be removed in a jiffy when not in use. Just mount it on a strong board, which is then wedged between the supporting timber and the basement floor as shown.

—Henry A. Schaefer, Chicago.



Broken Ladder Rung Repaired With Length of Pipe

A broken ladder rung can be repaired with little trouble by using a length of pipe cut to fit snugly between the ladder sides. Bore out the ends of the broken rung, put the pipe in place, and then drive short dowels through the rung holes and into the pipe. Toenail small nails into the dowels through the ladder sides to prevent the dowels from working out.



Solving HOME



Instead of fastening a towel rack to the wall where it is always in sight, attach it to a wood upright so that when needed, it can be clamped to a table edge and removed for storing away in a cabinet



A jar rubber looped over the hand as shown here will give you a nonslip grip to loosen a tight fruit-jar lid

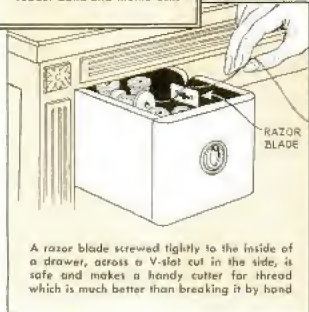


Stooping is not necessary to engage or release a rubber-type doorstop, if it is attached to the door with a rubber band and thumbtacks



A good way to hold a soiled clothesline when scrubbing it, is to wrap it around a washboard

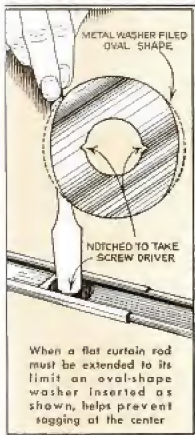
Keep your ball of quilting yarn in a box while using it. This will prevent it from rolling off the quilt and possibly becoming tangled



A razor blade screwed tightly to the inside of a drawer, across a V-slot cut in the side, is safe and makes a handy cutter for thread which is much better than breaking it by hand



PROBLEMS



You can make basement stairs safer for youngsters if you stretch a rope on the wall from top to bottom for them to grip

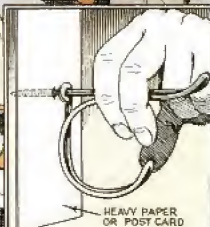
Ties can be kept flat in a suitcase if inserted through slits cut in a piece of cardboard



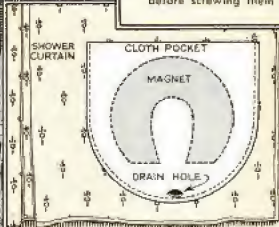
You'll be less apt to injure yourself by running against closet doors in the dark when left partly open, if the edge of the door is painted white or aluminum



ALUMINUM OR WHITE PAINT



Marring woodwork can be avoided when installing wire coat hooks, if you place a cardboard under the point before screwing them in



Small permanent magnets in pockets sewed to the corners of a shower curtain will help confine the spray as they tend to hold the curtain close to the side of the tub

Garden Hose Makes Smooth Edge Around Top of Wooden Barrel



When wood barrels are used as storage bins, the rough top edges that are apt to tear shirt sleeves or may cause bad scratches on one's arm, can be covered to avoid this trouble. Old garden hose is ideal for this purpose and can be attached quickly by slitting it and driving small nails in from the side.

—W. F. Schaphorst, Newark, N. J.

Angle Iron on Rung of Ladder Is Convenient Foot Scraper

As many accidents caused by slipping on a ladder are due to muddy shoe soles, why not screw a piece of angle iron on the bot-

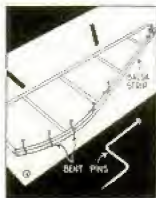


tom rung and use it as a foot scraper? It does not interfere in any way with handling the ladder and also tends to strengthen the rung.

—Everett Hanson, Argyle, Wis.

Model-Airplane Parts Assembled With Bent-Pin "Clamps"

Sticking pins through small model-airplane parts to hold them in position while assembling will not be necessary if bent pins of the type shown are used for the purpose. These are easy to insert, and will eliminate the possibility of splitting and breaking off tiny pieces of the wood.



Emergency Paint-Scraping Brush From Metal Lath and Block

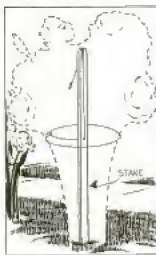


If a steel brush is not at hand the next time you want to remove old paint from the outside of a building, tack a strip of metal lath onto a block of wood and

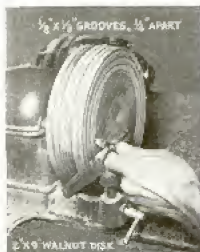
use this as a substitute. You will find that it does the work and costs little to renew.

Large Peony Bush Supported By Invisible Stake

Instead of using several stakes and hoops to support a large peony bush, one gardener uses one stake and some cord. The stake is set in the center of the bush and the cord is used as indicated. With this method, both the stake and cord are hidden by the plant.



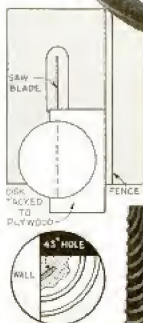
Wall Brackets of Unusual Design Turned in Lathe



These brackets are just the thing to decorate a wall where nothing else seems to fit. They are also ideal to use at the sides of large pictures and similar places. To make a pair of them, first turn a walnut disk 9 in. in diameter and 2 in. thick. Then turn five $\frac{1}{8}$ by $\frac{1}{8}$ -in. grooves in the edge, spacing them approximately $\frac{1}{4}$ in. apart. The outer grooves should be $\frac{3}{16}$ in. from the sides. Now turn ten similar concentric grooves in the front side of the disk. Next cut rings $\frac{3}{16}$ in. deep and wide enough to fit the grooves in the edge from the edge of a maple disk 9 in. in diameter and $1\frac{1}{8}$ in. thick. The rings are glued in place, and a small section will have to be cut from each one to make them fit into the grooves. The sizes of the rings for the grooves in the side of the disk can be determined by caliper. All rings should project $\frac{1}{16}$ in. and the sides of them should be tapered to make a tight fit when they are forced into the grooves. After the glue has dried, the work is remounted in the lathe, and the back of the disk is turned down carefully to the center of the first ring. Also, the edges of the rings are rounded to form beads. Then the disk is sawed in two, and the halves fastened back to back with $\frac{3}{8}$ -in. dowels. Sawing the work in half again gives you two brackets inlaid on the edge and both sides. The brackets are hung as shown in the circular detail.

—Benjamin Nielsen, Aurora, Nebr.

❏ If there is a good circulation of air in your cellar during the warm weather, the first floor of the house will be cool. Two windows, well screened, on opposite sides of the basement should be left open.

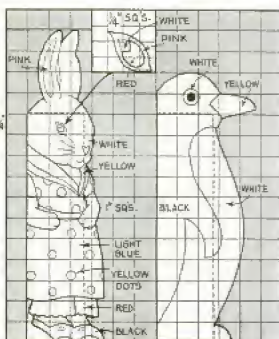


Self-Sealing Stopper and Wiper For Art-Brush Cleaner

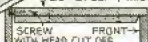
A stopper for a bottle of art-brush cleaning fluid that is self-sealing, and will also serve as a brush wiper can be made from a hollow rubber ball. An opening is cut in one side to make a tight fit over the mouth of the bottle, and a slot is made in the top. The slot is opened for inserting the brush by pressing on both sides of it. When withdrawing the brush, letting the slot close a little converts it to a brush wiper.



Cleaning-tissue



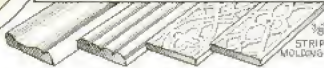
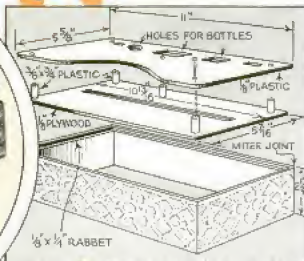
CLD - 2 PCs, 1/4" THICK



With its colorful animal sides, you'll want to hang this dispenser in the nursery. All the parts are cut of 1/4-in. plywood and assembled with glue and brads. If penguins are preferred to rabbits, the squared drawing gives a pattern for both. A headless screw to engage a hole in the back is used to support the lid so that a box of cleaning tissues can be slipped inside from where the tissues can be removed through a slot in the front.



The dispenser shown below is doubly useful for it not only makes an attractive jacket to conceal the tissues, but displays a handy manicure rack as well. Construction is simplified by the use of standard molding which you can purchase in a variety of shapes in both relief and embossed designs. The short rods which support the manicure rack above the slotted box top, are drilled for 1-in. screws. The sunken part of the molding may be painted blue and the raised part finished natural.



DISPENSERS

in disguise

Appropriate for use in the kitchen, the dispenser shown at the right appears to be just another shelf to hold a canister set, but close inspection will disclose that it contains a supply of cleaning tissues. The cutaway drawing shows how easy it is to make from $\frac{1}{4}$ and $\frac{1}{2}$ -in. stock, most of the joints being simply butted, glued and nailed. A decalcomania transfer applied to the drawer front will add a finishing touch.

To refill the novel dispenser shown in the circle below, you simply unscrew the two screw hooks to release the box located behind the tilting hairpin drawer. The tissues are accessible through an opening under the drawer. Except for the drawer body which is shaped from a solid block, plywood is used throughout. To engage the pins and stops, the drawer must be fitted in place before you nail on the sides. For variety, use colored tissues of a contrasting shade.

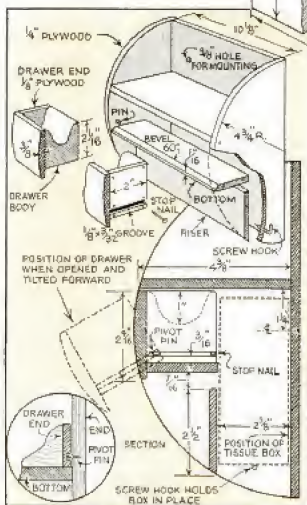
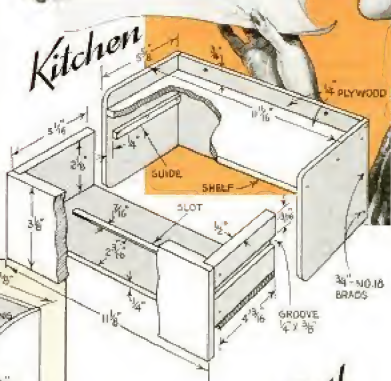


Photo
Courtesy
Kleenex Tissues

Claw Hammer Silences Squeaks When Filing Hand Saw



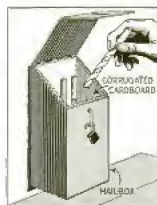
It is unnecessary to use any special made silencer to prevent squeaks when filing a hand saw. Simply hang a small claw hammer over the teeth of the saw as indicated. There is little possibility of the hammer damaging the teeth, but it may be suspended over those that have not yet been sharpened if desired.

Upholstery Tacks Simulate Eyes On Cotton-Stuffed Animals

Instead of sewing buttons on cotton-stuffed animals to simulate eyes, use upholstery tacks for the purpose as they are much easier to attach. All you need to do is bend the ends to form hooks as indicated, which provide positive anchors when inserted into the cotton.



Handy Box for Small Tools

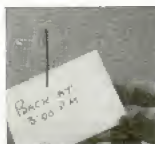


A mailbox that you can obtain for less than a quarter makes a handy box for drills and other small tools. It can be mounted in any convenient place, and it can be locked with a padlock. If you want to keep

edged tools in the box, a lining of rubber or heavy cardboard will protect them against the metal sides and bottom.

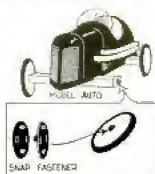
Bobby Pin Holds Card Securely To Screen Door

By slipping one side of a bobby pin in the mesh of a screen door, it will serve as a convenient clip for attaching small cards that give information to callers. Both sides of the pin press against the screen and will hold a card securely from being blown away.

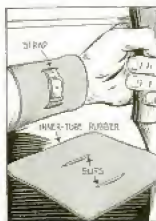


Wheels Attached to Tiny Models With Snap Fasteners

Tiny wheels may be attached to model cars, trains and airplanes with common snap fasteners as shown. One section of the fastener is countersunk and attached to the model while the other section is glued or soldered to the wheel. A drop of oil on each fastener will make the wheels rotate freely.



Inner-Tube Shield Protects Wrist In Archery Practice

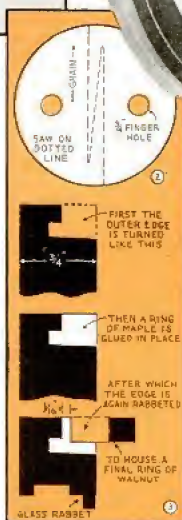


To protect your wrist from the whip of a bow string in archery practice, cut a piece of rubber from an old inner tube and slit it in two places near the center. It can be held in place securely by slipping both sides of your watch strap through the slits before fastening the watch around your wrist.

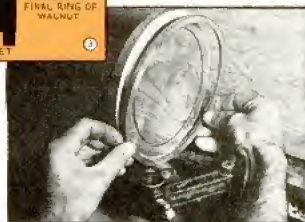
Inlaid Picture Frame Has a Wood Spring Back



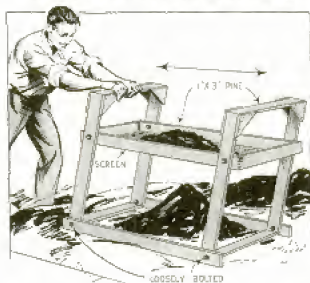
A novel back and a thin "two-in-one" inlay give this walnut picture frame a striking appearance, and make it an appealing project for the home craftsman. Figs. 1 and 2 show how the one-piece back is sawed to produce a spring effect to keep it in place, while Fig. 3 gives the steps in inlaying. After turning a walnut disk to the desired size for the frame, the front edge is turned to form a rabbet as shown in the first step of Fig. 3, making the waste stock into a ring to be used later. Then the bottom of the rabbet is extended as indicated and a maple ring is turned to fit this edge and glued in place. After which the edge is again rabbeted. Then the maple is turned down so that the walnut ring, which was removed originally, can be replaced. After removing the waste stock from the center of the frame, it is mounted on a wood-disk chuck to turn the rabbets for the removable back and glass face as shown in the last step of Fig. 3. The opening for the back must be large enough to permit the insertion of the glass. The back is a disk sawed almost in two from opposite sides with a piece left in the center to serve as a spring. The two $\frac{3}{4}$ -in. holes serve as finger grips for pressing the back together when inserting or removing it.



Inlaying is done by turning off one edge to take a maple ring, which is rabbeted to take a narrow walnut ring



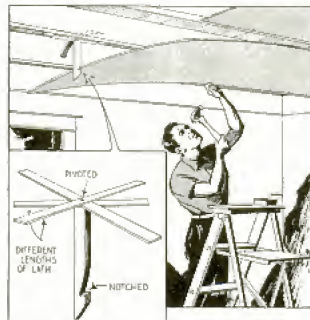
Rocking Screen Sifts Dirt Quickly For Lawns and Small Gardens



Having difficulty in sifting a couple loads of dirt with an ordinary screen sieve, I made a rocking one in less than an hour that enabled me to do the job quickly. Scrap lumber was used to assemble the framework and the legs were held in alignment at their top ends by means of corner braces. The screen was pivoted loosely to the legs and the latter were pivoted to the base frame.—Paul J. Allen, Chicago.

"Sky Hook" Holds Wallboard While Nailing It to Joists

If you cover ceiling joists with wallboard, this hook will be a big help in holding one end of the sheets while nailing. It is a notched stick to which a lath is nailed or



screwed, the lath being just long enough to fit between the joists when bowed. If spaces vary between the joists, several laths of varying lengths may be attached to the notched stick by a single pivot nail so that any one may be used when needed.

Preserving Wet Paint Brushes In Paper Bags

When doing a job of painting that requires more than one color, you can keep the brushes from drying out overnight by inserting the bristles in paper bags, as indicated in the drawing. When this is done, all of your brushes can be inserted in one can of linseed oil without the various colors running together.—Opie Read, Jr., Chicago.



Making Water Colors at Home With Colored Pencil Lead

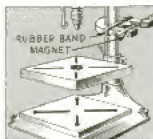


Colored pencil leads can be used to make water colors. Just drop a piece of the lead in a can lid or saucer, add several drops of water with a small brush

and let it dissolve. Various shades may be obtained by mixing the colors.

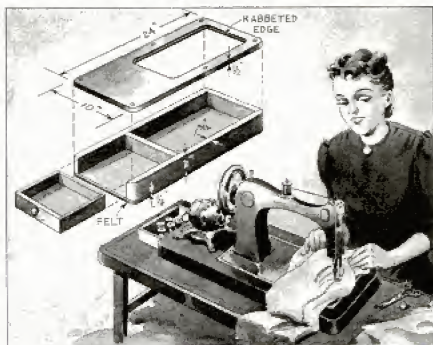
Magnet Used as Drill Holder

One of the handiest holders for drills at a drill press is a large magnet taken from an old magneto. The magnet fits around the drill-press standard, and a rubber band from an old inner tube holds it securely at any desired height.—G. E. Hendrickson, Argyle, Wis.



How to Make an Old Sewing Machine Portable

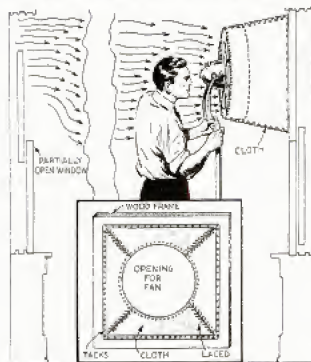
Would you like to have your foot-powered sewing machine converted to a modern portable electric one that could be moved easily? If so, here's a simple way to convert it. First obtain a suitable motor with a friction-drive pulley and a foot switch, remove the sewing-machine head and measure the opening in the old cabinet. Next cut a mounting board with a similar opening and fasten the head securely to it. This is screwed to a boxlike base that is cut and assembled from hard or soft wood as shown, with a drawer in one end to accommodate thread and other sewing equipment. After placing the motor so that its pulley rests against the sewing-machine drive wheel, the motor is screwed or bolted securely in place. A



piece of felt glued on the bottom of the sewing-machine base prevents it from scratching table tops and other surfaces and an oiled silk or rubberized cover shaped to fit the machine helps to keep dust from settling on it when not in use.

Modern Floor-Type Fan Ventilates Large Banquet Hall

To ventilate a large banquet hall, I use one of the modern floor-type fans placed in front of an open window that is fitted with a wood frame on which is tacked a



cloth shield that slips over the fan as shown. Four pieces of heavy cloth, used to make the shield, are laced together with heavy cord, and the shield is laced also to the fan guard. In use, a window on the opposite side of the hall is opened partially from the top and the fan speed is regulated to avoid a strong draft.

—Elmer O. Kling, Norwalk, Conn.

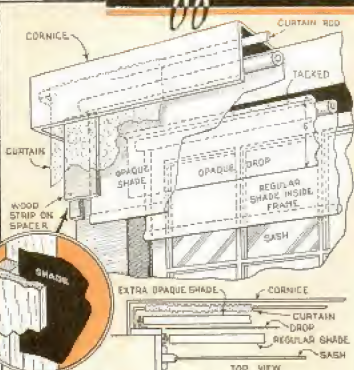
Cord Seals Storm Sash Tightly

Storm sash are sometimes ineffective because they do not fit tightly, especially on warped window frames. One way to seal the joint between the sash and frame is



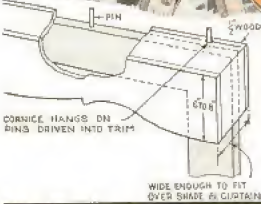
to lay a cord in shellac on the inner surface of the sash close to the edge. When the sash is put in place, the cord rests against the jamb and provides a flexible seal.

Effective

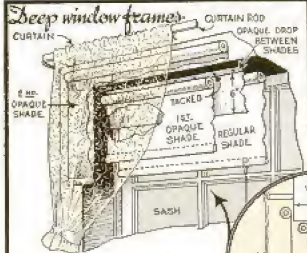


Shallow window frames

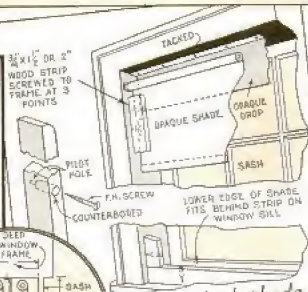
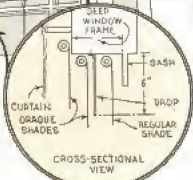
In addition to the regular shade, mount an opaque shade over the window frame with wood strips at the edges to prevent light leakage. Tack an opaque drop to top to hang between shades, and provide a closed cornice. Extra shade should be pulled down past the sill.



WIDE ENOUGH TO FIT OVER SHADE & CURTAIN



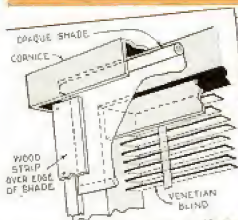
Here two opaque shades are installed over the regular shade, eliminating need for wood strips. Inner shade must fit over window frame. Opaque drop is tacked to top to hang between two shades.



Using single shade

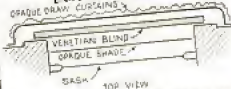
Simplest treatment on average window if the shade is completely opaque. Wood strips are screwed to sides and sill, and opaque drop is tacked between shade and sash.

WINDOW BLACKOUT

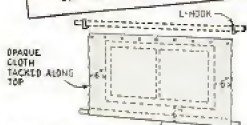


Treatment of windows having Venetian blinds fitted between sides of frame, and a cornice across top

Venetian blinds



How opaque draw curtains plus opaque shade are used when Venetian blinds are fitted over window casing



JACKED TO STICK TO ROLL UP AND HANG ON L-HOOK

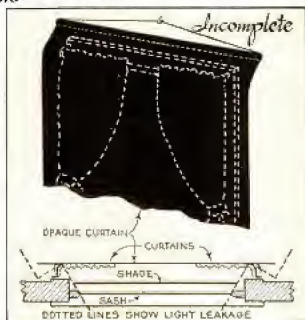
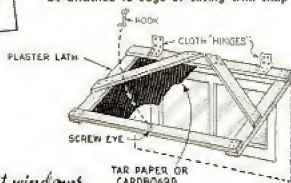
Basement windows

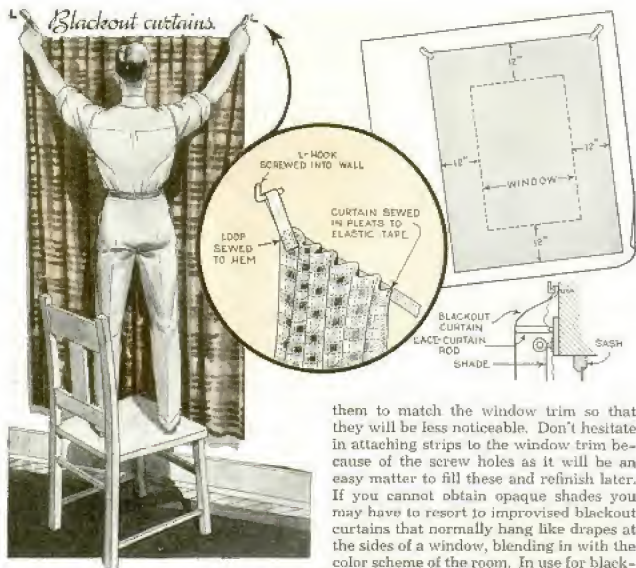
THESE semi-permanent installations for blacking out windows of dwellings are intended for use in vicinities where blackouts are frequent. They enable home owners to black out windows quickly and effectively with the least interference in the normal routine of the household. Having windows in constant readiness for blackouts is a great advantage over resorting to improvised, laborious and time-taking methods of draping heavy blankets or attaching large pieces of wallboard over them each time warning signals sound, when a saving of time really counts. With windows properly blacked out, you can have sufficient illumination inside your home, yet not a trace of it outside. Generally it is advisable to reduce the amount of illumina-



Draw curtains

Heavy draw curtains are usually not sufficiently opaque to permit using them only. An opaque shade between the curtain and sash, plus a closed cornice, will make the arrangement effective. Also, edge of the curtain should be attached to edge of casing with snap fasteners





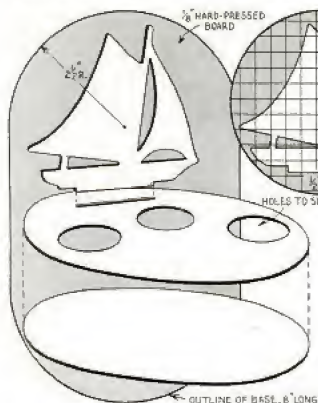
nation inside to the bare requirements, just in case your "opaque" material is not so fully opaque as you think it is. Of course, you must test the arrangement fully before depending on it to meet requirements.

By carefully and thoroughly studying the drawings, you will find one or more methods that will apply in your home, whether you have shallow or deep windows, whether you have draw curtains, Venetian blinds or simply shades. Opaque shades are those that do not permit any light to pass through them—the heavy dark green shades often are opaque, but the lighter colored ones seldom are. Where cornices are suggested, be sure that they are closed at the top as their purpose in blackouts is to prevent light from getting behind the top of the curtain. In nearly every case, a 6-in. drop of opaque cloth is tacked to the top of the window to seal this edge against the passage of light. If you follow methods in which wood strips are suggested over the edges of the shades to prevent light leakage, you can finish

them to match the window trim so that they will be less noticeable. Don't hesitate in attaching strips to the window trim because of the screw holes as it will be an easy matter to fill these and refinish later. If you cannot obtain opaque shades you may have to resort to improvised blackout curtains that normally hang like drapes at the sides of a window, blending in with the color scheme of the room. In use for blackouts, they are drawn across the window so that there will be a double thickness of material. Each curtain is hung from a sturdy L-hook driven into a stud of the wall, at least 12 in. above and also 12 in. on one side of the window. If you can get elastic tape, sew a length to the upper edge of the curtain and provide a strong cloth loop at each upper corner so that when hooked to the screw eyes on either side of the window, the curtains will pull up tightly against the wall. If fully opaque cloth is used, only one curtain is needed for each window, but if the material is not fully opaque you will have to have two curtains of suitable material to obtain the same effect. Skylights should be painted on the outside with flat dark brown or dark olive paints of a spar-varnish type which meet government requirements.

☛ Slide fasteners are nicer to use on slip covers than snaps or fasteners. The covers stay in place perfectly and it only takes a jiffy to remove them for laundering.

Sailboat Cutout Decorates This Condiment Set

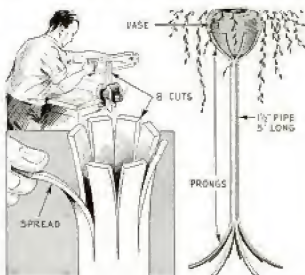


Adding a touch of decoration to any table, this novel condiment set can be jigsawed from either $\frac{1}{8}$ -in. hard-pressed board or $\frac{3}{16}$ -in. plywood. The first thing you do is obtain a set of salt and pepper shakers with a mustard pot to match. Then enlarge the boat pattern to full size, trace it onto the material and saw it out. Two oval base pieces are made next, one of them being slotted and bored to receive the boat cutout, shakers and mustard pot.

When thoroughly sanded, the base pieces are glued together, after which the cutout is glued in place, using heavy books or blocks of wood on each side to hold it upright while the glue dries. For a finish, colors should be selected to match the shakers. Or, if they are glass, you can redecorate them when finishing the holder, which is given two coats of good enamel, sanding lightly after the first one.

Novel Plant Stand Is Formed From Single Length of Pipe

Besides being simple to make, this novel plant stand is inexpensive as it is cut and bent from a single 5-ft. length of $1\frac{1}{2}$ -in. pipe. Both ends are marked off in eight sections, after which they are slit with a hacksaw. If a saw frame that permits the blade to be turned is not available, you can start the cuts, remove the frame and use the single blade to finish, by fitting both ends of it with improvised handles. The top end sections are shaped to accommodate a vase or flower pot, while the bottom sections are spread to form a base, the latter being a little longer than the top sections to provide a solid support. Rubber tips on the base prevent marring floors.



METAL RAILING
SOLDERED TO NAIL
HEADS DRIVEN
INTO DISK

$\frac{3}{8}$ " X $\frac{5}{8}$ " DISK
WITH 6 $\frac{3}{8}$ "
SLOTS

11" DIA.
ENAMELED
WASH
BASIN

AIR
VENTS

2 WOOD SCREW

5-QT.
CAN

FLOOR

$\frac{5}{16}$ " X $\frac{3}{8}$ "
SLOTS

DOORWAY

1-GAL. CAN

CRIMPED
WITH
PLIERS

5-QT. CAN

FLOOR

$\frac{5}{16}$ " X $\frac{3}{8}$ "
SLOTS

HALF LAPPED

FLANGE

STYLE
B

$\frac{1}{16}$ " X $\frac{3}{8}$ "
BRASS

STYLE
C

STYLE
C

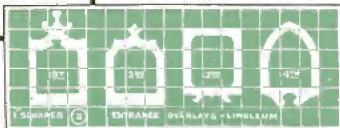
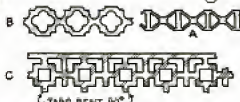
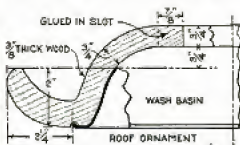
STYLE C RAILING

Swank MARTIN

Two unusual designs—one a four-room miniature Chinese pagoda and the other a twelve-room hexagon-shaped house covered with asphalt roofing. Both are ventilated, arranged for quick cleaning and can be closed to sparrows before the martins arrive

By A. L. MILLS

STANDARD-SIZE tin cans for the body and a common wash basin for the roof simplify the construction of the pagoda-type house. Fig. 1 shows how the ends of the three cans slip into each other and how they are held together by nailing through the porches and into the ends of the buttresses which are spaced equidistantly around the sides of the cans. Assembly is begun from the top down to permit the wash-basin roof with its ornamental trim, to be attached to the upper can with a screw from the inside. Both ends of the lower 5-qt. can, including the bead at the bottom, are removed, but only the bot-



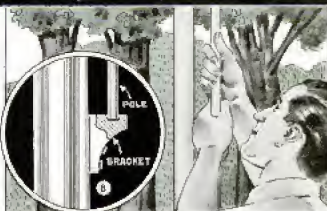
APARTMENTS

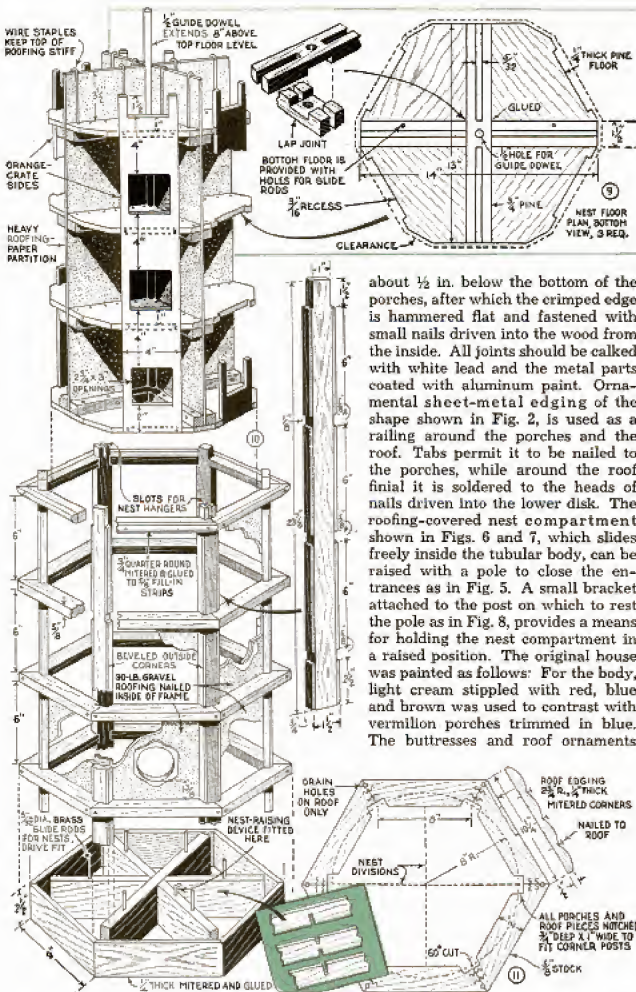


tom of the upper can; the top of this one is perforated as shown for ventilation, and punched through the center for fastening the roof. Note that the 1-gal. center can has the ends removed and is cut down in length. The doorways, which differ in shape to correspond with the overlay patterns given in Fig. 3, can be cut easily with a small cold chisel by slipping the open can over the end of a length of pipe. Roofing cement is used to attach the linoleum overlays around the doorways. The dotted lines indicate the approximate position of each nest floor when the inner compartment is in place. To make it easy to pass the cans through the circular openings cut in the notched porches, the metal is crimped slightly with a pair of pliers. The center and upper cans should extend

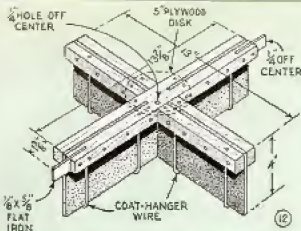


COVERED WITH 30-LB. GRAVEL-SURFACE ROOFING PAINTED ALUMINUM OUTSIDE



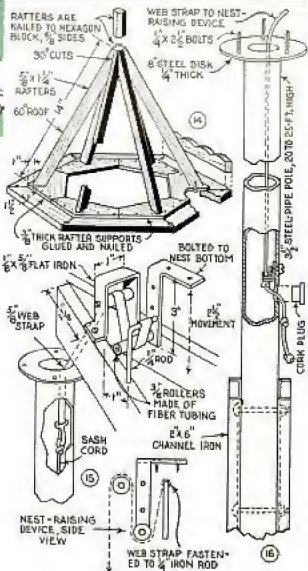
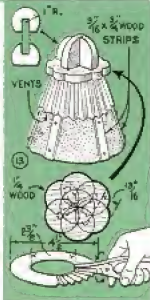


about $\frac{1}{2}$ in. below the bottom of the porches, after which the crimped edge is hammered flat and fastened with small nails driven into the wood from the inside. All joints should be calked with white lead and the metal parts coated with aluminum paint. Ornamental sheet-metal edging of the shape shown in Fig. 2, is used as a railing around the porches and the roof. Tabs permit it to be nailed to the porches, while around the roof finial it is soldered to the heads of nails driven into the lower disk. The roofing-covered nest compartment shown in Figs. 6 and 7, which slides freely inside the tubular body, can be raised with a pole to close the entrances as in Fig. 5. A small bracket attached to the post on which to rest the pole as in Fig. 8, provides a means for holding the nest compartment in a raised position. The original house was painted as follows: For the body, light cream stippled with red, blue and brown was used to contrast with vermillion porches trimmed in blue. The buttresses and roof ornaments

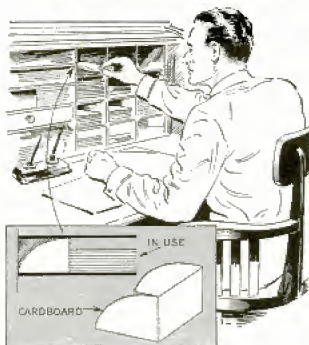


also were done in vermilion, but striped in black and gold. Light blue was selected for the roof itself, while aluminum was applied to the finial and porch railings. The entrance overlays were of black linoleum.

The 12-room house shown in Fig. 4 also has a movable inner compartment for closing the entrances, which in this case is raised and lowered from the ground by a rope running down through the supporting pipe post as shown in Figs. 15 and 16. Scrap pine will do for the body and inner framework, and Figs. 9, 10, 11 and 12 detail the construction and assembly. In making the nest compartment, allowance must be made for the roofing paper which lines the inside of the body so that the former will slide easily. A 2 1/4-in. wood disk around which a knife may be guided is handy for cutting the doorways in the roofing before fastening it at the corners with cleats. Note that an opening must be cut in the bottom floor over the nest-raising device to allow the compartment to rest on the cross members, after which the mechanism is enclosed with a box cover. Figs. 13 and 14 show how the roof framework is made and covered with roofing, the platform of this being notched and assembled according to Fig. 11, to set over the body corner posts. Battens nailed to the rafter edges after the roofing has been applied, and painted a contrasting color, add to its appearance.



Pigeonholes of Desk Are Altered To Take Short Envelopes



If the pigeonholes of your desk are so deep that you find it difficult to remove standard length envelopes or folded letters, plug the holes at the back to shorten them. Pieces of cardboard cut and bent as shown in the inset will do the trick.

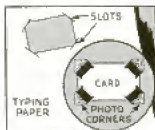
How to Avoid Wrinkled Stencils



You can avoid wrinkles in a mimeograph stencil when inserting it lengthwise in a long-carriage typewriter, if a narrow strip of paper is folded in the center and slipped over the edge of the stencil. The folded strip stiffens the edge, and after passing under the typewriter platen, it is removed.

Typing Small Cards Easily

The next time you have a number of small cards to be printed in a typewriter, here is a good way to hold them in the machine. You can



either cut four slots in a sheet of paper to take the corners of the card, or you can use photo-mounting corners suitably spaced on the paper.

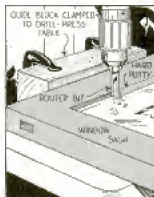
—Richard Sklenar, Tekamah, Nebr.

V-Notch Filed in Jaws of Pliers Aids in Gripping Pins

By notching the jaws of a pair of pliers as indicated in the drawing, you can use them to grip steel pins, small rods, etc., firmly. Pliers altered in this way are especially handy for inserting these small parts in places where it is practically impossible to reach with the fingers.



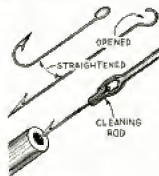
Putty Routed From Window Sash On a Drill Press



Confronted with the work of removing old putty from a number of window sash, one home owner did the job easily by routing it out on a drill press. The sash was removed from the windows and held on the drill press table under the router bit, using a guide block clamped to the table to keep the sash in line with the bit.

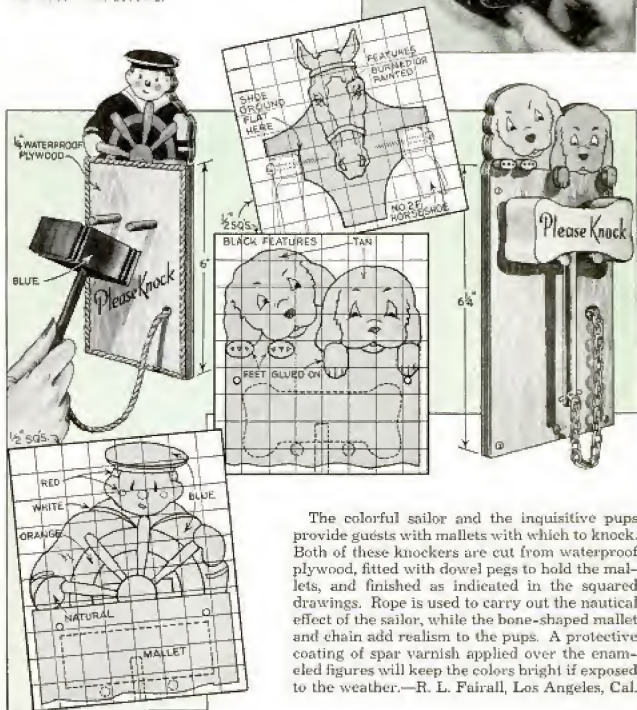
Fishhook Removes Cleaning Swab From Rifle Barrel

To remove a cleaning swab in a rifle, straighten a fishhook and attach it to a cleaning rod as shown. When inserted in the rifle barrel, the barb will snag the swab so it may be pulled out easily.



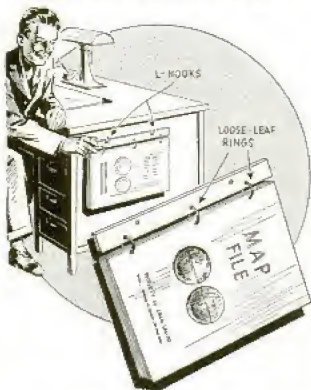
Novelty DOOR KNOCKERS

Just the thing to add an informal touch to the cabin, cottage or recreation room, these novel door knockers are easy to make and fun to use. A common horseshoe forms the knocker of the one shown at the right. The horse head to which the shoe is pivoted, is jigsawed from $\frac{3}{4}$ -in. wood, following the pattern given below, and is attached directly to the door with screws.



The colorful sailor and the inquisitive pups provide guests with mallets with which to knock. Both of these knockers are cut from waterproof plywood, fitted with dowel pegs to hold the mallets, and finished as indicated in the squared drawings. Rope is used to carry out the nautical effect of the sailor, while the bone-shaped mallet and chain add realism to the pups. A protective coating of spar varnish applied over the enameled figures will keep the colors bright if exposed to the weather.—R. L. Fairall, Los Angeles, Cal.

Large Catalogues Held Together And Hung on End of Desk



Catalogues and folders that are too large for your desk drawers can be held together and kept conveniently at hand by hanging them on a couple of L-hooks screwed in one end of the desk as shown. Simply punch the pages for three loose-leaf rings, which are also hooked in a ruler or piece of yardstick. Two holes along the top edge of the ruler are spaced so that they slip over both L-hooks easily.

—J. W. Augustin, Fond du Lac, Wis.

Making Envelope Self-Opening

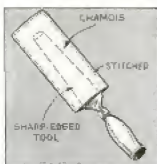
An ordinary envelope can be made self-opening by enclosing a length of thread under the flap when it is sealed, allowing the ends of the thread to project slightly. One of the ends can be fastened to the en-



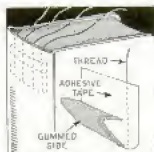
velope with cellulose tape, leaving the other free to be pulled outward to cut the envelope as shown.

Chamois Sleeves Protect Tools

Sharp edges of chisels and other types of cutting tools can be protected with chamois sleeves. This idea is especially handy when such tools are thrown in a box with others where their cutting edges might become nicked. The sleeves also tend to protect tools from rusting.



Threads Serve as Book Marks



You'll find it easy to locate certain pages of a book that are referred to constantly, if markers of the type shown are used. They are merely various colored threads

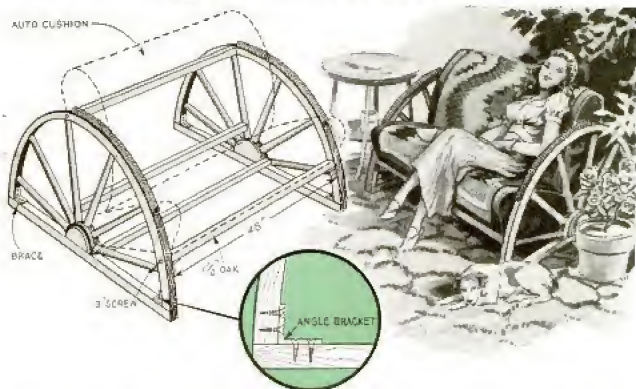
fastened in the binding with a strip of adhesive tape.—Paul H. Smith, Norfolk, Mass.

Walking Cane Provides Handle For Large Gaff Hook

After having difficulty in landing a large musky with a short-handled gaff hook, one fisherman obtained a larger hook, removed the handle and replaced it with an ordinary walking cane. The curved end of this handle provided a positive grip and made it unnecessary to bring the fish so close to the boat. It was also found that by using the gaff to hook a tree or pier, the boat could be held in position while landing.



Halves of Wagon Wheel Form Ends of Lawn Seat



If you need a lawn or porch seat, here's one that is inexpensive, comfortable and different. It consists of a discarded wagon wheel, cut in half, which forms the ends or arm rests. The upholstered seat and back are taken from an old auto body. After the wheel has been sawed in half, the flat side of each piece is fitted with an oak strip, angle brackets being used at the ends for bracing. Next, oak seat and back supports

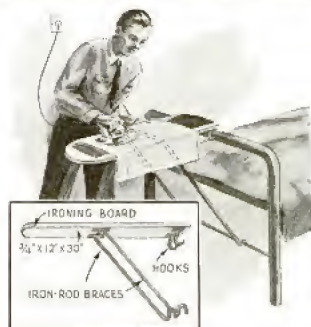
are fitted and screwed in place as shown. Although short lengths of flexible metal tubing were used to provide a round edge along the top of both wheel pieces, old garden hose will serve for the purpose if it is more readily available. A bright-colored Indian blanket makes an attractive cover for the seat, especially if the framework is painted a bright red to match it.

—Nathan Bogoth, Winnipeg, Man., Can.

Simple Ironing Board Hooks Over the Foot of Army Bed

After having considerable difficulty in finding a place to press his clothes, a private in one army camp made this simple ironing board that fits on the foot of his bed. The two supporting braces were bent from a single length of iron rod and hinged to the board as indicated. Hooks formed on the ends of the braces slip over the lower crosspiece of the bed while two additional hooks fastened near the end of the board, slip under the round top of the bed end. However, a wooden brace with straps at the lower end could be substituted, in which case a couple of cleats are nailed to the underside of the ironing board.

ⒸPipe cleaners are good for fastening rose bushes to trellises as they hold the vines without damaging them.



BEFORE YOU

With restrictions on building new houses, anyone contemplating the purchase of a house already built will welcome these practical hints in making a selection

By W. Clyde Lamme
Part I

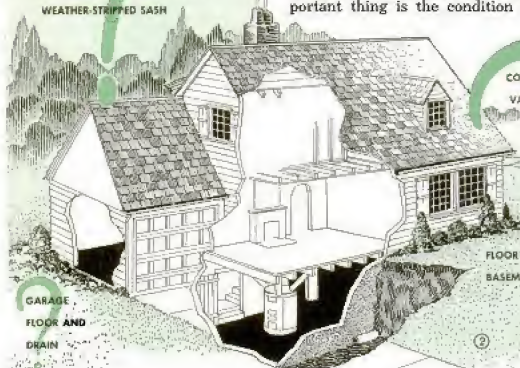
WHAT you get for your money in a house depends on you, for the values you attach to any home are both tangible and intangible. Whether or not you like the house, the grounds, the street or the neighbors you alone must decide and you will place your own valuation on such things as comfort, arrangement of the rooms, their location, and condition of the house.

The prospective buyer of a house is at a disadvantage in that there are many parts of the structure he cannot see. Hence the only thing he can do is to look for the results of faulty construction or other defects. It should be kept in mind that any cause of defects in one house is not always applicable to others. Alterations to correct structural faults in one instance may be costly while in another they may be relatively inexpensive. Although some defects are fairly common, they generally vary with each building so that no definite rule for cause, cost of repair or extent of damage can be relied on. The important thing is the condition of the building

FLUE LININGS AND CHIMNEY FLASHING
HEATING SYSTEM: WARM AIR, FORCED
AIR, HOT WATER, VAPOUR OR STEAM
PLUMBING, BATH AND KITCHEN FIXTURES
WOOD, METAL OR PLASTERBOARD LATH
LENGTH AND WIDTH OF GARAGE
WEATHER-STRIPPED SASH

COMPOSITION SHINGLES
VALLEY FLASHINGS
GUTTERS AND
DOWNSPOUTS
SCREENS AND
STORM SASH
DRAINAGE TILE
FIREPLACE
FLOOR JOIST AND BRIDGING
BASEMENT WALLS AND FLOOR

GARAGE
FLOOR AND
DRAIN



BUY A HOUSE

*Ceilings and floors
will tell you more
about the condition
of the structure
than any other two
parts of it*

itself. It may be old, and may appear shabby and run down, yet structurally it may be as sound and good as ever. Or, it may be new in years and old structurally. When you look at an older house keep in mind that it costs relatively little to apply paint, change a partition or two, remove a ponderous porch, lay new floors and trim, or put in a "picture" window. But if, in modernizing, you have to rebuild the interior, install a new heating plant, change the entire roof line, excavate a basement and put in a new foundation wall or rebuild a faulty chimney, the cost of any or all of these major items added to the purchase price may result in a prohibitive figure.

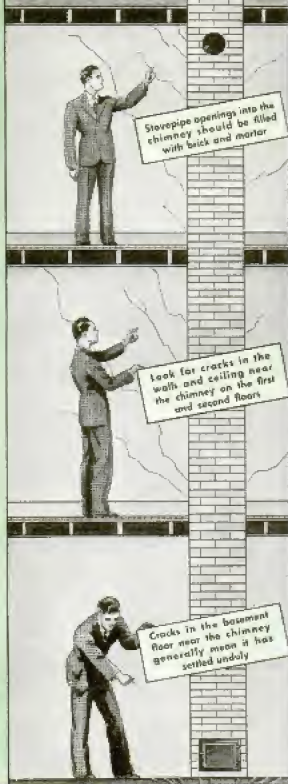
Usually you will be invited inside the house first. Carry a notebook, Fig. 1, and jot down all the important details. Look carefully at the ceilings and floors, Fig. 3, for it is here that certain deficiencies in the structure usually show up. In Fig. 2 you see listed both interior and exterior details. A fault in any of these will show up inside the house. For example, if the downspouts do not have concrete splash blocks or other provision for drainage, there is likely to be seepage of water into the basement. If flashing around the chimney or in roof valleys is defective, leakage into the attic will loosen plaster and cause other damage to walls and ceilings. Take



time to go over the basement thoroughly. Note if there is a cleanout door in the chimney and particularly whether there are any cracks in the floor near the base of the chimney, Fig. 4. Usually, but not always, such cracks indicate undue settling and if you examine walls and ceilings upstairs you may find a condition as shown in Fig. 6. Where walls are papered you will have to look closely to find the cracks. Sometimes in old houses the walls have been papered for years without filling the cracks and replastering. Here settling probably is complete, and once the wall is repaired you are not likely to have further difficulty. But in a new house, the condition may be a constant source of trouble.

DUE TO FAULTY FLASHING,
WATER OFTEN WORKS
DOWN TO CEILINGS

④

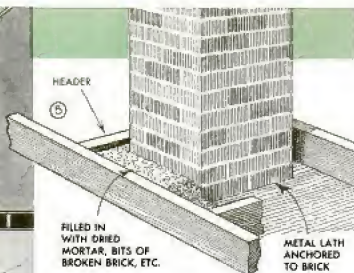


HEADER

⑤

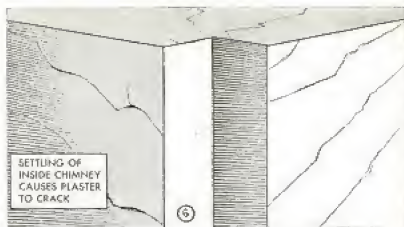
FILLED IN
WITH DRIED
MORTAR, BITS OF
BROKEN BRICK, ETC.

METAL LATH
ANCHORED
TO BRICK



Fine, hairline cracks are not important, but wide ones and large areas of loose plaster adjacent to the chimney mean that considerable movement has taken place. While looking for loose plaster near a chimney, it's a good idea to tap the walls all the way around each room. Should this disclose large areas of plaster loose from the lath it will be necessary eventually to replaster the whole wall. This defect can be due to causes other than a settling chimney. When you get up in the attic, notice the construction at the point where the chimney comes through the ceiling. This depends somewhat on the location of the chimney and the time it was built, but approved construction specifies that there be no wood within 4 or 5 in. of the brick. Fig. 5 shows one method.

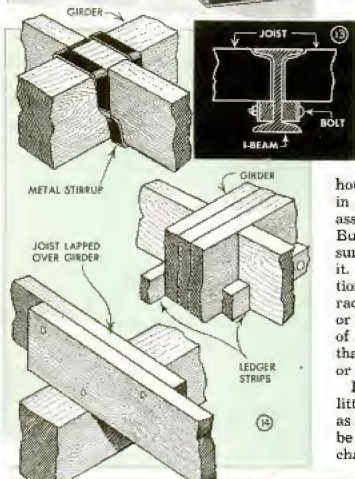
Open cracks extending laterally in basement walls, Fig. 10, are generally caused by unequal strains due to insufficient footing. However, there are numerous other causes for the slow breaking up of monolithic walls. "Honeycombing," due to improper proportions of materials, insufficient mixing, inadequate "puddling," and segregation of materials by careless pouring are also causes of slow disintegration. In some cases a whole section of the wall is "broken" out, separated completely by large cracks and the edges of the latter will often show that one section has slipped past another. This condition may be due to inadequate cross section in proportion to height or load. Where there are constant accumulations of ground water in the grade, such walls will not only leak badly but under repeated freezing and thawing may break up entirely. If the house is built in an area forming a natural "sump," or



where there is insufficient drainage, you may find a concrete-block wall cracked something like that shown in Fig. 11. Here upper and lower sections are tipped inward at the break. Place a straightedge vertically to determine the extent of tipping and whether it varies along the length of the wall. Look all the way around the basement for vertical zigzag cracking of joints between the blocks. If you find these cracks running more or less vertically in a block, masonry or monolithic wall which otherwise appears to be of good construction and adequate proportion, the cause is generally instability of the ground under the foundation footings. Irregular settling caused by this condition sets up unequal strains which tend to crack the wall vertically. But if the cracks are diagonal or irregularly horizontal and a straightedge shows the wall tipping inward at the breaks, then action of frost in a water-logged grade is a common cause, although under certain conditions water pressure alone can crack the walls.

Concrete floors are sometimes broken up by pressure due to water displacement. Not all basement floors are put in over an adequate cinder fill, and frequently the floor is too thin or the mix is too lean. Tap the floor lightly with a hammer. If the sound of the tapping is uniformly flat the chances are the concrete is of sufficient thickness and is over a tamped cinder fill. But if there is a hollow sound at any point it means that either the slab is thin at this point or the ground underneath has settled away leaving it unsupported. If the area is large the floor may break up in time. Also note the slope of the floor to the drains. Occasionally, where the drain is





stopped with a screw-in plug, water backs from the storm sewers with such force that it breaks the tile near the trap, letting the water in under the floor, which often results in cracks and flooding of the basement.

Examine the interior of the furnace with a flashlight, Fig. 12, noting the condition of the grates and the firebrick lining. Condition of the heating plant is more important than age or type. After the furnace, take a close look all along the center supporting beam, noting especially how the ends of the floor joists are supported. Figs. 13 and 14 show the common methods. The important thing here is whether the ends of the joists are pulled away from the beam, if they are supported in stirrups or on ledger strips. If they are pulled away, the cause may be shrinkage along the length, the span may be too great, causing joists to bend slightly. Also, it may be that basement walls have settled out of plumb, or have settled more than has the center girder, resulting in the condition shown in Fig. 9. If you see this, check the upper floors and inside door jambs with a spirit level, Figs. 7 and 8. If the floors and jambs are only slightly out of plumb in an older house, and if the basement walls are still in good condition, it is generally safe to assume that the condition is not serious. But if you see this flaw in a new house, be sure to find out the cause before you pass it. Among other causes for such a condition are severe windstorms that may have racked the structure slightly out of plumb, or a cloudburst may have been the cause of more settling within a matter of days than would normally take place in months or years.

In almost every house there are many little things, most of which may be classed as nuisances or inconveniences. Many can be corrected easily but some cannot be changed. For example, a basement stair-



AMERICAN COLONIAL



DUTCH COLONIAL



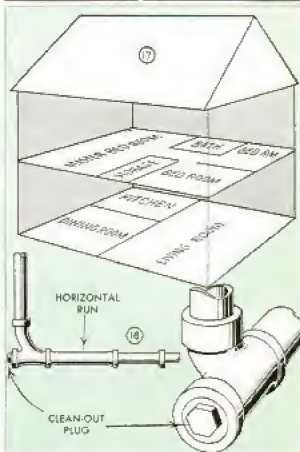
CAPE-COD COLONIAL

way may be too steep or the proportions of tread width to the height of the riser incorrect. Or, the hot and cold-water pipes may run too close together resulting in unpleasantly warm drinking water. Also, the kitchen sink may be located so that one must stand with back to the light, or it may be too low, or the drainboard may be on the right, an inconvenience to a right-handed person. A fireplace that smokes and cannot be repaired readily is worse than useless. Again you may see a pedestal lavatory placed so close to the bathroom wall that it's impossible to clean behind it. In this connection, omission of a clean-out plug in the soil pipe, Fig. 18, is generally taken as evidence of skimping but in some communities this is forbidden by local ordinance because of the danger of untrapped fixtures being attached by unauthorized persons.

Learn if possible the name of the contractor who built the house. From him you probably can get the specifications which will tell you about the grades of material used, whether the walls are insulated and many other details you cannot see.

If you are about to buy an old house and are planning to modernize it, or if you have looked at a number of houses and wish to keep the arrangement of each more clearly in mind for purposes of comparison, it will help to make simple sketches of each one as in Figs. 16 and 17, using the notes you made at the time of viewing each one. Such sketches are not difficult to make and they are a valuable help in visualizing changes or in determining values. Fig. 15 shows six common architectural types of homes. Of each one you will find many variations, for architects and builders are continually searching for economies in materials and labor costs. It frequently happens that slight changes in the basic design will effect considerable saving.

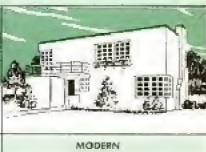
(To be continued)



GEORGIAN

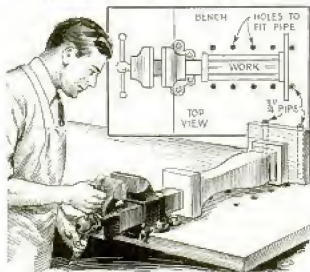


SPANISH



MODERN

Bench Vise Used to Exert Pressure When Gluing Large Pieces



Clamping large pieces while gluing is no problem for one craftsman who uses his bench vise to exert pressure on the work. Two rows of holes were bored in the bench top directly in line with the sliding vise beam, after which a couple of 10-in. lengths of pipe were cut to serve as stops. In use, one end of the work is placed against the vise beam and the pipe stops moved up to brace the other end.

Countersink to Use in Brace Or a Hand Drill



A countersink or screwdriver bit having a square shank can be adapted for use in either a brace or three-jaw chuck by rounding part of the squared portion. This can

be done on a grinder, and the rounded part should be about $\frac{3}{8}$ in. long.

Simple Holder for Lashing Thread While Tying Flies

To hold a spool of thread handy for tying flies or for repairing a fishing rod, drive a couple of nails into the cabin wall above your work

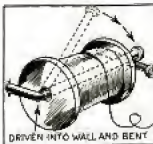


table and bend one of them at right angles as shown. The spool may be slipped over the bent nail, which is then dropped down to rest on the opposite nail.

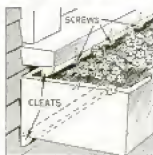
Notched Can Lid Suspends Brush In Cleaning Solution

Instead of setting your paint brushes in a can of turpentine or cleaning solution, it is a much better practice to suspend them in the liquid as this avoids bending the bristles out of shape. Just cut a notch in the lid of



the can as indicated, so that the lower part of the brush handle will fit in it securely.

Easy Way to Hang Window Boxes



Try using two wooden cleats instead of unsightly hooks or hinges to hang window boxes. These are nailed to the underside of the window sill and to the side of the

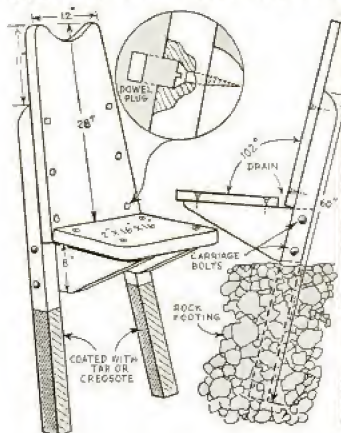
house, the box resting on the lower one with its rear edge hooked under the one on the sill. The box must be strong so that the rear side will not pull off.

Setting Eyelets or Hollow Rivets

When installing eyelets and hollow rivets where a regular tool for this purpose cannot be used, a countersink used as a punch will do the job. The countersink will cut the shank of the eyelet so it can then be spread with a hammer. The eyelets and rivets are of soft metal so that using it for this purpose will not damage it.



Garden Seat Anchored Permanently in Place



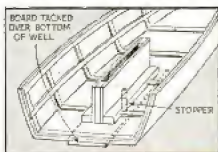
Set in the ground at some advantageous spot in the garden, this outdoor lounging chair offers ready seating comfort the year 'round. It is especially fitting when used with an outdoor settee as part of your rock garden, or when set in your favorite nook

or retreat. All parts underground should be coated with tar or creosote before the chair is put in place. As water drains naturally from the tilted seat, painting it once every couple of years will assure long life.

—J. Modroch, Danbury, Conn.

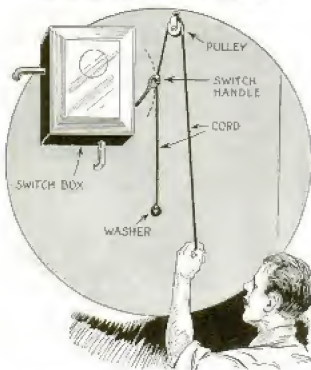
Painting Inside of Sailboat Center-Board Well Done Easily

Difficulty of painting narrow center-board wells on small sailboats often induces the owners to let them go unprotected against the ravages of worms. The owner of one small boat avoids this expense and trouble by plugging the bottom of the well and then pouring the paint into it. The plugging is done by nailing a board with a stoppered drain hole over the well. After filling the well with paint, the stopper is pulled out and the paint that does not adhere to the sides of the well is drained back into its container. Then the board is removed.—H. Coolidge Adams, Jr., Springfield, Paget, Bermuda.



ⒸWhen hanging wallpaper you can avoid wrinkles at the corners of your rooms if you cut the paper just a little beyond the corner, about 2 in., then either lap or butt the next piece.

Extension on Switch-Box Handle Provided by Two Cords



As the switch box in my house is located near the ceiling, making it inconvenient to get at when making minor electrical repairs, I attached a couple of cords to the handle so that it can be operated without the necessity of standing on a stool or step-ladder. One cord is tied to the switch handle and hangs straight down while the other one is passed over a small pulley attached to the ceiling or wall, making it possible to raise the handle when desired. Washers tied on the cord ends keep them from getting tangled.

—William Lee, Montreal, Que., Can.

Thumbtacks Raise Ruler to Avoid Ink Blots When Ruling Paper

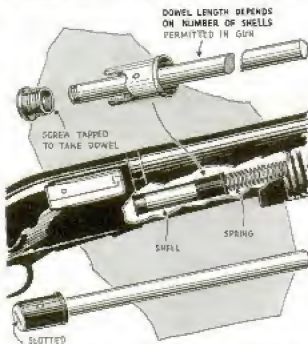
When a triangular ruler is used for ruling inked lines, it may be raised to avoid blotting or smearing the work by forcing



a couple of thumbtacks into one of the grooves. The tacks will not interfere with easy movement of the ruler, and they may be removed easily when not needed.

Gun Plug in Cartridge Magazine Is Easy to Insert and Remove

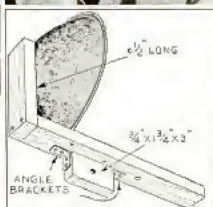
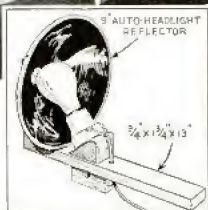
If you do considerable hunting with a shotgun in localities where the use of a plug is prescribed by law to limit the number of shells carried in the gun, you'll find a plug like the one shown easy to insert and remove. It is inserted from the cartridge-loading end instead of the usual way of inserting a plug from the muzzle end of the magazine. Instead of a plain length of dowel, the closed end of the cartridge carrier inside the magazine is bored out and fitted with a brass cap. This is threaded to screw inside a brass sleeve, which is a drive fit inside the cartridge carrier. The cap is bored and threaded so that the plug can be screwed into it. Then the



cartridge carrier with its brass cap is replaced in the magazine. Now, when it is necessary to use the plug, "break" the gun, remove the brass cap, insert the plug and reassemble. In this way, the plug cannot slide back and forth inside the magazine when the latter contains less than three shells.—Richard F. Gomoll, Chicago.

⚡ A half teaspoon of borax dissolved in very hot water and added to the water in which glasses and silver are washed will make them sparkle.

Spot and Floodlight Combined in One Lamp



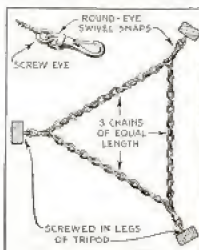
This inexpensive lamp for indoor photography concentrates the light in a spot on the subject, and at the same time acts as a floodlight. A No. 1 photo-flood bulb is mounted in a socket on a triangular block so that the bulb is tilted into the reflector to focus the light. The lamp housing is a length of furnace pipe or stovepipe from which the seam is cut out, the severed edges being flanged and nailed to the sides of the horizontal strip carrying the bulb and reflector. A bolt and wing nut pivot the lamp to its standard.

Chain Arrangement on Tripod Keeps Legs From Spreading

Here's simple, effective assurance against having the legs of your tripod slip apart on smooth surfaces. Just open three screw eyes to take swivel snaps and after closing the screw eyes drive them into the tripod legs as shown. Three equal lengths of chain are used between the snaps. By having the

same number of links between the snaps, you can vary the spread of the legs. The snaps, chains and screw eyes cost only a few cents, yet they may save an expensive camera from being broken.

—Arthur Haug, Chicago.



Ground Glass Substitute

When you need a small piece of ground glass and none is at hand, you can make a satisfactory substitute by coating plain glass with soap. Rub a bar of soap over one side of the glass, then work it around with the fingers until it is evenly distributed. A piece of glass treated in this way will enable you to check the focus of your camera without going to the expense of buying ground glass.

—E. F. Whiteside, Wilmette, Ill.

Holder Lifts Camera Above Head For Shooting Over a Crowd



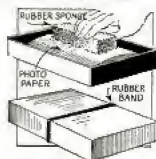
Shooting photographs of parades, athletic events, etc., over the heads of a crowd is simplified with this camera holder. Small enough to slip into a pocket, it can be carried easily and attached to the camera quickly when needed. The holder consists of a short length of broomstick with the threaded end of a short bolt projecting

from one end to screw into the camera. A counterbored hole through the stick holds the cable release in position so it can be operated by the thumb of the hand holding the camera aloft.

—Martin Dunagan, Amsterdam, N. Y.

Rubber Sponge in Paper Box Keeps Sheets From Curling

Unused sheets of photographic paper stored in a box will not curl if a rubber sponge is placed under the lid on top of the paper. It is best to slip a strong rubber band around the box to be sure the sponge is held tightly against the sheets and to prevent it from forcing the lid up and admitting light which would fog the paper.



Deadening Glossy Surfaces

In photographing brightly polished objects, such as machinery, strong reflections sometimes make the job difficult. One way to overcome the difficulty is to rub a piece of putty over the shiny surfaces. This will make an even, dull finish which photographs well.

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Popular Mechanics Press, Dept. 366, 200 East Ontario Street, Chicago, Illinois

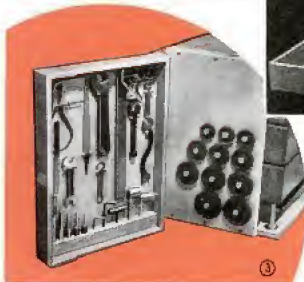


SHOP NOTES

TOOLS *at your* FINGERTIPS

Compact, portable tool cabinet has swinging sides and trays that display your tools in full view and within easy reach

MACHINISTS and others will find this portable cabinet a timesaver, as it keeps tools neatly arranged where they can be selected instantly. In the original are contained all the chucks, wrenches, tools and odds and ends needed for a 6-in. lathe, drill press, shaper and jigsaw. Figs. 2 and 3 give you an idea of its capacity. The trays are hung on a vertical axle, and swing out individually at the touch of a finger. Each one can be divided into compartments

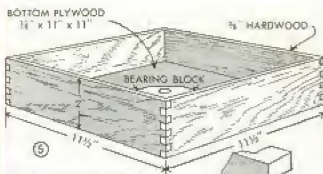


as desired. There is a shelf under the trays for notebooks, blueprints, etc., and on the door panels are hung turning chisels, wrenches and various other items. Made of hardwood, each tray will stand a weight of 10 lbs. without sagging noticeably.

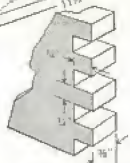
Five-ply birch is recommended for the framework, which is glued and screwed together. Where the glued surface is large



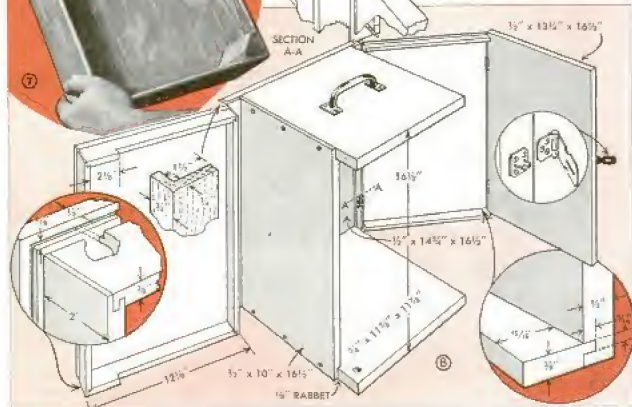
Getting a correctly fitted bottom panel helps to strengthen the tray

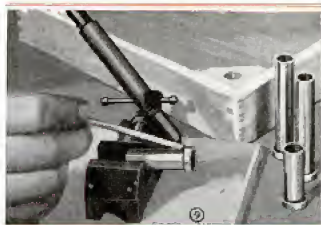


MAKE TWO TRAYS 2" DEEP AND TWO 3 1/2" DEEP



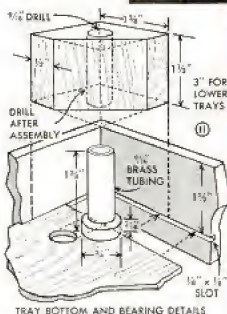
in proportion to the load it must carry, the screws may be omitted. In this case, the joint is secured with clamps, using softwood pads under the jaws to distribute the load, Fig. 10. The center and right-hand doors, Fig. 1, are hinged together and swing as a unit; and they can be any depth, which is determined by the thickness of the tools to be mounted. As there is considerable weight on the doors, the strongest hinges and largest screws possible



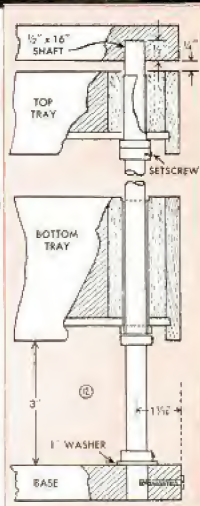
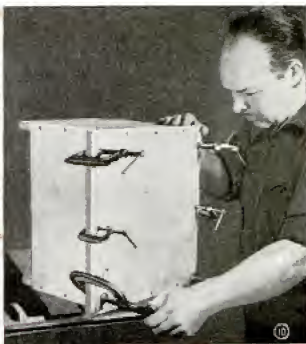


should be used. The left-hand door, Fig. 8, is framed with shoulders to give clearance for the double-panel arrangement.

The trays, Fig. 5, are made of birch or maple and are held together entirely by glue. Your cabinet work must be done carefully here, for the trays depend on tightly locked corners for their rigidity and strength. The eight sides for the two shallow trays are sawed to size and clamped together, Fig. 6, so that the tenons can be cut at one time. If you have a dado head this can be done with one cut, otherwise three or four will be needed. Then, the slots for the bottom panels are cut and the trays assembled, Fig. 4.



Bearing blocks, Fig. 11, to suspend the trays on the vertical axle are first squared, and then the saw is tilted and one corner is cut off at 45 degrees, after which they are glued in place. To assure all four being in line, a guide is clamped to the drill-press table and all four trays are bored for the bearings. Next, the edges of the trays, top and bottom, are rounded, and the corners sanded down, Fig. 7. The axle, Fig. 12, is a length of $\frac{1}{2}$ -in. steel shafting, and the sleeve bearings are $\frac{3}{16}$ -in. tubing with an inside diameter of $\frac{1}{2}$ in. Thrust collars of $\frac{3}{4}$ -in. brass are soldered over the ends of the sleeves, Fig. 9, and bearing surfaces are turned on the bottoms. The sleeve and the inside of the bearing hole are coated with glue, then pressed into place from the bottom. The axle is fed up from the bottom and seats in a socket in the underside of the top panel. When seated, the thrust bearing at the base is tightened down, and a $\frac{1}{2}$ -in. hole is bored from the side of the base and through the axle. This is for a torque screw, which keeps the axle from turning. Each tray turns on a thrust bearing, which is made from a slice of the same $\frac{3}{4}$ -in. brass used for the thrust collars. These are turned to fit the axle and are held in place with steel setscrews.



Trough Keeps Artist's Brushes Conveniently at Hand



Window-sign painters and others who do similar work will find this simple trough just the thing to hold their brushes conveniently within reach. It is made from a piece of rubber hose, and is fitted with a vacuum cup so that it can be attached on a window or other smooth surface.

Pockets or Bags Emptied Quickly By Opening Slide Fasteners

Carpenters can save a great deal of time by sewing slide fasteners in the bottoms of their nail-apron pockets. This provides a quick means of emptying the contents at the end of a day or changing sizes of nails

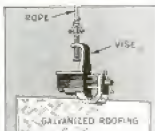


when moving to a new job. Fruit pickers and others also will find this method convenient for providing fasteners at the bottom of bags that must be emptied often.

Small Bench Vise Used as Clamp To Lift Metal Roofing

Needing a clamp on the end of a rope to raise sheet-metal roofing to the top of a building, one workman found that a small bench vise was just the thing. The rope was tied to the clamp screw of the vise, and the metal roofing was gripped firmly between the jaws.

—James Vick, Church Road, Va.



Altered Cap Screws Clean Threads In Tapped Holes



If the threads in a hole tapped for a cap screw or stud have become corroded or slightly bent, you can still drive in the screw if the end is quartered with a hacksaw as shown. After slotting the screw, the slots are closed, which tapers the end so that it can be screwed into place.

—John Krill, Youngstown, O.

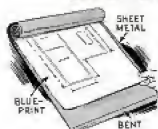
Hack-Saw Blade Is Handy Tool For Cleaning Sickle Guards

Time required for cleaning mower and binder sickle guards can be greatly reduced by using this simple tool, which is made by bending a piece of an old hack-saw blade and wrapping friction tape



around one end to provide a comfortable handle. In use, the blade is worked back and forth in the guard slots to remove gummed particles of weeds and grain.

Blueprint Used on Job Rolls Up Inside Metal Holder



While on a job, one contractor protects his blueprints by keeping them in portable holders which are nothing more than pieces of sheet

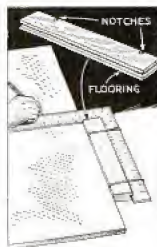
metal bent as indicated. In use, the print is inserted so that it can be pulled out for inspection or pushed back so that it rolls up inside the tubular part of the holder.

Rubber Disks Under Thumbtacks Keep Paper From Tearing

Artists and draftsmen who have trouble with thumbtacks tearing thin paper while erasing, can overcome the difficulty by slipping a rubber disk under each thumbtack. Such disks are easily cut from an old pencil eraser, and they greatly increase the grip of the thumbtacks.



Flooring Block on Steel Gauge Aids in Marking Thin Panels



The difficulty of using a steel square along the narrow edge of thin panels can be overcome by attaching a scrap length of flooring to the square. After planing off the tongue and notching the piece, it is fastened to the square with rubber bands.

Booster Legs Raise Loaded Truck Over Door Sills



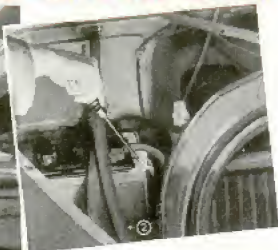
Pushing a loaded truck over door sills was simplified by one produce merchant who attached booster legs to his truck. These consisted of a heavy piece of flat iron bent to the shape indicated and bolted to the sides of the truck. In use, the truck is pushed up to the door and the handles lowered to raise the wheels flush with the top of the sill.

Simple Reel on Plumb-Bob Cord Is Always at Hand

A piece of sheet metal, pressed wood or plywood, cut and drilled as indicated, and strung on the cord of your plumb bob, will provide a winding reel that is always at hand when needed. It does not interfere in any way with using the plumb bob and cannot be lost if several knots are tied in the end of the cord to prevent it from slipping off. In use, the reel is located near the upper end of the cord—not near the bob.

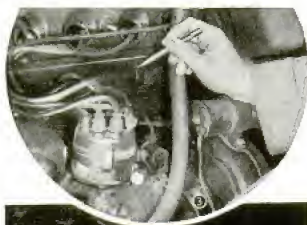


WHAT to CHECK when



Appraising used cars for true values—what to look for and what you should avoid

Exceptionally heavy oil often is used to help silence noisy and badly worn motors. Also, heavy oil is used frequently in order to minimize oil pumping and resulting troubles



A LEAKY RADIATOR MAY COST SEVERAL DOLLARS TO REPAIR

By James R. Ward

WHEN you cannot get a new car and you must resort to a used one, a good selection depends on how much you know about its mechanical condition, unless of course, you can enlist the services of a capable mechanic on whose judgment you can rely. There are a number of relatively simple checks by which poor values can be eliminated.

When going out to look at cars, don't become overly enthusiastic about any one until you have made such checks. Too often the good appearance of a new paint job entices the unwary buyer, but the careful buyer, apprehensive of true value, is more interested in the condition of the motor which will give him reasonably long service without expensive repairs. Also, many buyers depend on the speedometer reading as a criterion of wear. However, a high mileage record does not necessarily mean excessive wear of the motor. For instance, if a car, perhaps one driven by a salesman, has been driven continuously for long trips, and it has not been abused, the motor may be worn less than a car used for making innumerable short trips, such as in city driving. The reason for the difference in condition is that the long-run car was started less frequently and it is the lack of proper lubrication when starting, especially in cold weather, that wears off

BUYING A USED CAR

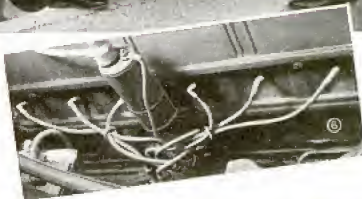


A cracked exhaust manifold, damaged gaskets between manifold and motor or other joints in the exhaust system may permit carbon-monoxide gas to enter the car

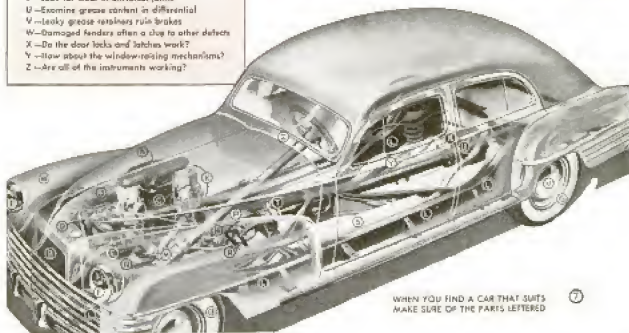


POINTS TO CHECK

- A —Is the battery in good condition?
- B —Is the radiator clogged or leaky?
- C —Look for cracked exhaust manifold
- D —Does water pump leak?
- E —Is the generator charging?
- F —Are headlamps in good condition?
- G —Slow about the tires?
- H —Check the clutch for grabbing
- J —Is motor noisy?
- K —Examine motor for cracks
- L —Has frame been damaged?
- M —A worn steering gear is dangerous
- N —The cylinder oil tells a story
- P —Watch for a leaky or noisy transmission
- R —Good brakes are essential
- S —Avoid a leaky exhaust system
- T —Look for wear in universal joints
- U —Examine grease containers
- V —Leaky grease containers ruin brakes
- W —Damaged fenders often a clue to other defects
- X —Do the door locks and latches work?
- Y —Slow about the window-raising mechanisms?
- Z —Are all of the instruments working?



Rotted or frayed insulation on spark-plug cables and other high-tension wires will have to be replaced for good motor operation

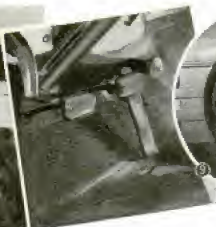


WHEN YOU FIND A CAR THAT SUITS
MAKE SURE OF THE PARTS LETTERED

7



COVERING RADIATOR GIVES QUICK WARM-UP TO CHECK NOISY MOTOR



Worn pedal pads and floor mat will belie the reading of a speedometer that has been set back to indicate a low mileage



SMOKE LIKE THIS TAKES LOTS OF OIL AND A COSTLY REPAIR TO STOP IT



A DENT HERE MEANS A BAD BUMP



Evidences of repaired fenders may mean that the frame or front end of the car was damaged in an accident

much more metal on moving parts than continued driving for many miles after oil has circulated to provide a protective coating on these parts.

As you go along from car to car you can make a few quick preliminary tests that will help eliminate the worst ones. As the oil is a good indicator of motor condition, raise the hood and look at the oil-gauge stick, Fig. 1. If it shows that the oil in the crankcase is exceptionally heavy, you can suspect that it was used to silence a noisy motor, or that the motor uses entirely too much oil of lighter viscosity, due to worn piston rings and cylinders. A strong odor of gasoline in the oil, and dirty black oil are also indications of worn piston rings, or worse, which will require an expensive repair job to correct. A thick coat of grime over the motor also means loss of oil, and likely ruined ignition wires, Fig. 6.

While the hood is raised, glance at the battery, Fig. 2. Often a carrier or hold-down frame covered with fresh corrosion indicates an old battery at least, and maybe a cracked one. Look at the battery cable to see if the insulation is worn off, and check for indications of cracks in the motor, Fig. 3. Examine the exhaust manifold, Fig. 5, for cracks that might fill the car with dangerous carbon monoxide gas. Glance at the fire wall where the radiator brace rods enter, Fig. 11. If there is a dent at this point, it was likely put there in a wreck. Check the radiator for leaks, Fig. 4. Run the tips of your fingers over the fenders, Fig. 12. Small bumps may indicate a repaired fender; then you should be on the alert for a bent frame or front end.

When you open the door, examine the edges, Fig. 18, to see if the car has been



repainted. An undercoat of paint of different color than that on the body usually shows up here. Sometimes old taxicabs are repainted and sold as used cars. Good upholstery cloth, Fig. 19, and floor mats are a fair indication that the previous owner has given the car good care. Don't be misled by a low speedometer reading. Speedometers are often set back several thousand miles, sometimes to zero. Wear on the pedal pads and floor mat may contradict the reading of a speedometer that has been set back. For example, notice the speedometer, pedals and floor mat in Fig. 9. All are on the same car, but it took a lot more driving than the mileage indicates to wear the pedals and mat as shown—at least 20,000 miles.

Next, look at the front tires as they

Excessive wear on the front tires is a good indication that something is mechanically wrong with the frame or front end



Rocking the front wheel when the car is on a jack will give you an idea of the condition of the spindle bushings



If the tires have been regrooved, check to see if grooves have been cut too deeply into the fabric. Also, be on the alert for a frame that has been repaired as the car may have been in a bad wreck



are a good, quick "barometer" to the condition of the front end. The photo of the one on the left in Fig. 17 indicates wrong toe-in or toe-out, which is remedied easily. But the one on the right shows that something is wrong mechanically that might be quite expensive to repair.

Now that simple preliminary checking has enabled you to examine several cars in a comparatively short time, and to



"weed" out the bad ones, pick out the most suitable one for further testing. You may find several minor faults that the dealer may be willing to repair before you buy the car, which he would not do after the car has been delivered. When you are ready to make further tests on the car, notice the salesman's attitude. If he is hesitant about you checking further, or if he tries to distract your attention at this time, you should be doubly thorough in the rest of the checking as he may know of some serious defect. Any salesman who has nothing to hide will be glad to cooperate with you in making further tests.

The tires are of great importance. Have they been regrooved, Fig. 15, and was a good job done? If they are worn, are there any breaks in the carcass that would make them unsuitable for retreading, Fig. 13? Jack up the front wheels and check for wear in the spindle bushings, Fig. 14. Too much looseness here may cause the tires to wear rapidly, or the wheels to shimmy on the road. While the car is on the jack, slip on a frock and crawl under the front end. Look for evidences of welding or straightening of the frame, especially at the points indicated by the arrows in Fig. 16. If any are found, it is likely that the car has been in a wreck. Usually you are taking too much chance in buying such a car, because subsequent wear of parts out of alignment may not be evident yet, but

will show up later. Also, misalignment at certain points of the frame will give you nothing but grief.

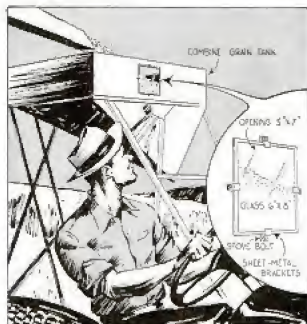
If everything is all right so far, you are ready to give the car a road test. As the motor should be heated to the proper operating temperature, you can save time by putting a blanket over the radiator before starting as in Fig. 8. Leave it on just long enough to get the temperature indicator pointing in the normal range. While traveling on a smooth, level street at a speed of about 25 m.p.h., let loose of the wheel. The car should travel at least 300 ft. without a tendency to pull toward one side; otherwise the front end needs attention—perhaps only adjusting. Also, see if there is excessive looseness in the steering gear and linkages. Next, pick a rough street and test the car for riding. Be sure to use the brakes too, both at high speed and at low speed, noticing if there is a tendency of the car to pull toward the side when the brakes are applied. If the motor has reached driving temperature by this time, accelerate rapidly and then decelerate quickly. Then, if considerable bluish-grey smoke pours out of the exhaust pipe as in Fig. 10, the car is an "oil burner," in which case it will need an expensive job of new piston rings, and perhaps reboring of cylinders. However, if the smoke is black, it may need only a carburetor adjustment.

With the motor hot and the oil thinned

down, any noise in the motor will be evident, which indicates wear. While driving, listen for growling or humming noises in the transmission and differential. Accelerate rapidly and progressively at all three gearshifts and listen for any indication of wear. Now refer to the table at the left of Fig. 6, and thoroughly check all the points indicated in Fig. 7 that have not been checked already. Be sure to examine the grease in both the transmission and differential. Sometimes cereal, ground cork and other materials are added to silence badly worn gears and bearings. Although some of the points indicated to check are only minor, a number of small repairs may involve considerable expense, and influence your decision.

Window in Combine Grain Tank Saves Operator's Time

On small combine harvesters equipped with grain tanks of the gravity type, the height of the tank makes it difficult for the tractor driver to see when the tank is full. To avoid the scattering of grain from overflowing and loss of time due to the necessity of stopping now and then to see when the tank is nearing full, one owner fitted the tank with a glass window as shown. A 6 by 8-in. panel of plate glass cut from an old auto windshield was located over a 5 by 7-in. opening cut in the sheet-metal side of the tank. The glass is held in place with four brackets made from heavy sheet metal and fastened on each side of the glass with $\frac{3}{16}$ -in. stovebolts.



Easy Method of Removing Gum From Under Counter

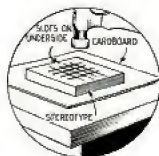


One proprietor of a lunch counter avoids the difficult job of removing chewing gum stuck to the underside of a counter by the customers by putting strips of paper at these points. Removing the gum is just a matter of stripping off the paper, which is held in place by adhesive tape.

Raising Low Spot in Stereotype

When casting type-high stereotypes in our shop, a low spot sometimes develops near the center of the plate, which goes unnoticed until a proof has been pulled. To save time and avoid recasting, I lower the blade of a metal-cutting saw to about 10 points below type high and make a number of criss-cross cuts directly under the low spot. Then, I lay the cut face down on a piece of cardboard placed on a smooth surface and strike the center of the sawed section a few hard blows with a hammer, gradually working to the outer edges. The result is an even type-high printing surface.

—Ira R. Wright, Osceola, Ark.



Mitten Sewed on Printer's Apron For Handling Hot Castings



In order to protect his hands and save time in handling hot type castings, one printer sewed a light mitten to the underside of his work apron as shown. It's a simple matter to slip one hand into the mitten and pick up a hot casting.

Coil Spring Is Showcard Holder

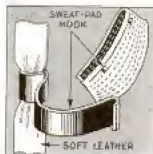


To make little holders for small showcards so that they will stand vertically, cut sections from an old screen-door spring and bend them as shown by means of two pairs

of pliers. It takes only a few minutes to make several and the cost is negligible.

Easy Method of Attaching Hooks On Horses' Sweat Pads

If you have trouble with the hooks coming off of horses' sweat pads, try this method of reattaching them. Remove all hooks that seem to be



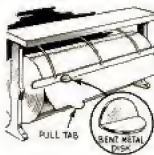
loose and cut a strip of soft leather about 1½ in. wide for each hook. Slip the leather strips through the hook loops, sew both ends on the pad and you have fasteners that will hold the hooks securely.

Washer on Cold Chisel an Aid In Cutting Metal Tubing

A road-construction foreman who had to cut sections of corrugated culvert tubing at times, welded a stout washer to the cold chisel used for this purpose. The washer simplified the work by serving the triple purpose of depth gauge, fulcrum and guide for the chisel.



Metal Piece on Paper-Rack Knife Leaves Tab to Pull Roll



The difficulty of grasping the end of rolled paper in a counter rack can be avoided if a small tab is left on the paper when it is torn off. A metal disk bent at right angles and soldered to the knife near one end will leave a tab as shown. The tab will project slightly so that it is easy to grip.

Inexpensive Stand-Off Insulators From Salt and Pepper Shakers

When strength is unimportant, inexpensive stand-off insulators can be made quickly from composition salt and pepper shakers of the type shown, which are available at most 10-cent stores. All you need to do is drill a hole in the



bottom of the shaker for an attaching screw and cut two slots in the top. To fasten the wire, it is only necessary to place it in the slots and screw on the cap.

—Arthur Trauffer, Davenport, Iowa.

Drill Press Serves as Clamp While Soldering

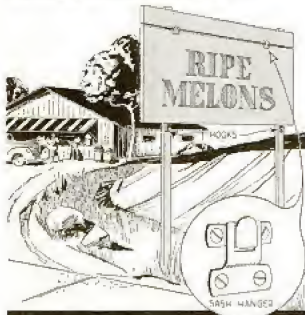


Irregular pieces often can be clamped together in a drill press while a joint is being soldered. The work is placed directly under the chuck so that it can be lowered to apply slight pressure after which the spindle is locked in place. A hardwood or asbestos pad under the work will prevent withdrawing of heat.

—Alexander Maxwell, Chicago.

Signs Hung With Sash Hangers Are Easy to Change

Instead of just nailing seasonal produce signs on a couple posts along the highway, why not fasten them so they can be taken down easily and stored until the following season? This can be done simply by using a couple of sash hangers. Screen-door hooks at the bottom of the sign hold it from being blown off the hangers.



Sections of Tires Keep Motorists From Driving on Painted Lines



To keep traffic from crossing newly painted white lines on the highway, in a Pennsylvania county, the paint crew uses sections of old auto tires. These are 6 to 8 in. long and are set astraddle the newly painted line. If one is accidentally hit by a motorist, there is no damage to the car.

Simple Carbon Electrode Holder For Arc-Soldering Outfits

Carbon electrode holders for small arc-soldering outfits of the battery-operated type are easy to make from a bicycle handle-bar grip and a battery clip. Just cut a small hole in the rubber grip for a lead wire, fasten the wire to the battery clip and push it back into the grip, leaving only the jaws project. To insert an electrode, the clamp jaws are opened by squeezing the holder.



—Robert V. Owen, Jr., Monroe, Ore.

Basic MACHINES in defense industries



Part II — By H. J. Chamberland

DRILL presses, essential in any machine shop, are the most versatile of power-driven machines. Besides drilling holes, they can be used for many other purposes on metal such as countersinking, counter-boring, tapping, grinding and a variety of other surfacing operations.

Parts of a drill press: Basically a drill press is a powered drill having variable speeds and consisting of four parts; base, column, table and head. See Fig. 1, which shows these parts except the base. The head comprises the entire working mechanism and includes a spindle, which revolves in bearings in a movable sleeve or quill and is slotted to engage a key of the

driving pulley, permitting up-and-down movement. Quill and spindle are moved downward by means of a feed lever. A spring raises them when the feed lever is released. Spindles may have a tapered socket to take taper-shank drills or they may be fitted with a key or keyless chuck to hold drills. A quill lock and a depth stop to limit downward travel are usually provided and often a pedal is connected to the feed arm so that feeding can be done with the foot, leaving both hands of the operator free to handle the work, Fig. 29.

Essentials for accurate work: For accurate work, a drill chuck, which holds the drill, must be concentrically true; the twist

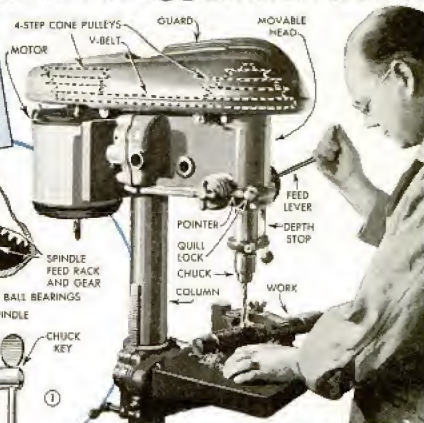
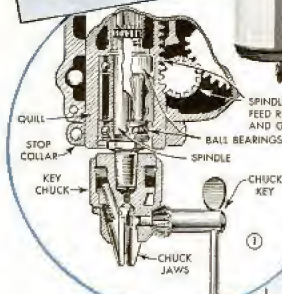
Calling all hands!

Do you want to be one of the skilled mechanics needed in national defense industries? Workers in large plants are trained for the jobs they are to handle, but you can supplement your knowledge of basic shop machines and know how to use them, by reading these practical, informative articles. The more you know, the more you can earn!

The DRILL PRESS and how to use it

Includes:

Preparing the work
Methods of clamping
Drill speeds and feeds
Sharpening twist drills
Testing and grinding chucks

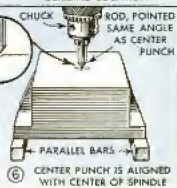
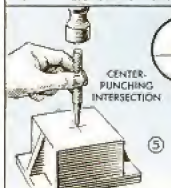
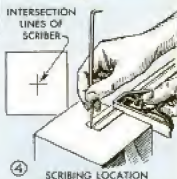
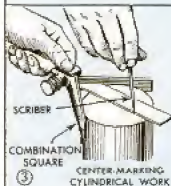
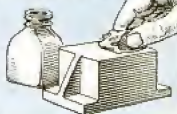


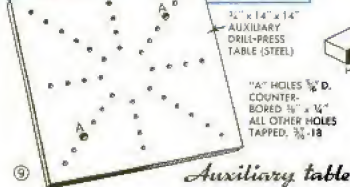
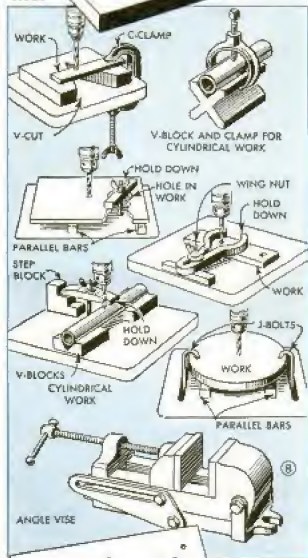
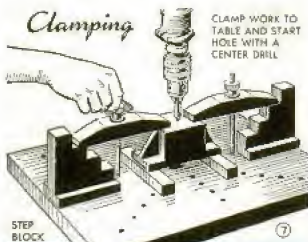
drills must be sharpened correctly so that both lips cut equally as twins; the correct speed and feed must be used, depending on size and kind of drill besides the kind of material; and the work must be held down on the table rigidly for maximum precision and also for safety to the operator. Prospective drill-press operators should familiarize themselves thoroughly with the mechanism itself, various types and sizes of drills, and their decimal equivalent measurement in size.

First adjust the table: Assuming that you are to operate a drill press in perfect condition for drilling holes in metal, using correctly ground drills, the first thing to do is to adjust the position of the table if this is to be used horizontally. Then it must be set at perfect right angles to the spindle. If the drill press is standing perfectly level, which shows by checking the column with a sen-

② COATING THE SURFACE FOR MARKING

COPPER-SULPHATE SOLUTION FOR POLISHED STEEL
20% SOLUTION OF SILVER NITRATE FOR COPPER AND BRASS
WHITE CHALK OR WHITING SOLUTION ON ROUGH IRON

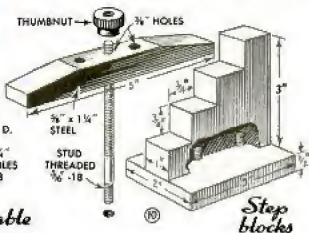




sitive level, the table can also be checked similarly. Also, you can use a machinist's or combination square on the table and against the spindle. Then the table is locked securely in right-angle-to-spindle position and you proceed to prepare the work for drilling.

Scribing and centerpunching the work: First you coat the metal as in Fig. 2 so that scriber marks will stand out clearly. To centrally locate a hole on the end of perfectly round shafting, use a combination square as in Fig. 3. Two intersecting scriber lines will indicate the center. On flat work use a square or rule as in Fig. 4 to measure and mark the exact position of the center of the hole to be drilled. Next comes centerpunching as in Fig. 5. Hold the sharp punch vertically and strike it with a hammer. Be sure the point is set accurately at the intersection of the scribed lines when doing this.

Work is clamped to table: Now you are ready to mount and clamp the work on the drill-press table. The indentation of the centerpunch is brought into alignment with the center of the spindle by means of a short rod held in the chuck, the rod being ground to a point the same angle as that of the centerpunch. See Fig. 6. Then the spindle is locked to hold the work in this position while it is being clamped to the table. Fig. 7 shows the use of two step blocks and hold-downs for clamping. Details for making these are given in Fig. 10. However, there are various methods of clamping different kinds of work, some of which are indicated in Fig. 8. In these illustrations the work is attached by various means to the regular table but some operators find that an auxiliary table made as shown in Fig. 9 is adaptable to many uses. This has many tapped holes for studs fitted with thumb screws to tighten the hold-



downs on the work. Two counter-bored holes take cap screws for attaching the auxiliary table to the regular table. After the work has been clamped to the table, a center drill should be employed to start the hole, especially if a large drill is to be used.

Fixture to drill circle of holes: When it becomes necessary to drill a series of holes in a circle, you will find the arrangement shown in Fig. 11 is both handy and accurate. This setup consists of a gear having the desired number of teeth for spacing the holes, a base to which both gear and work are concentrically attached, and a thumbscrew engaging a tapped hole on a projecting portion of the base to lock the gear in any position.

Drilling shaft end concentrically: Drilling a hole concentrically in the end of shafting is done as indicated in Figs. 12 and 13. A length of $\frac{1}{2}$ -in. drill rod, about as long as the shaft to be drilled, is rounded at one end. While this is held in the chuck, it is lowered to engage a $\frac{1}{2}$ -in. hole in a steel block, this hole being set over the approximate center of the table. When the rod slips into the hole perfectly, the block is clamped down after which a center, shown in the lower detail of Fig. 12, is set in the hole. Then the shaft, already centerpunched at both ends, is held on the center and drilling is begun at the upper end as in Fig. 13, using a center drill first.

Some helpful hints: It is very bad practice to whack



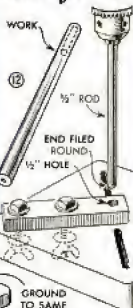
Indexing gear for circle of holes

FIRST—PUT $\frac{1}{2}$ " DRILL ROD IN CHUCK

SECOND—SHIFT BLOCK ON TABLE SO ROD WILL SLIDE INTO $\frac{1}{2}$ " HOLE, STATIONED AT CENTER OF TABLE, THEN TIGHTEN BLOCK ON TABLE

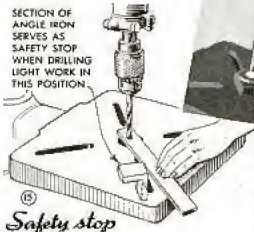
THIRD—WITHDRAW ROD, AND SLIP CENTERING PIN IN HOLE

FOURTH—AFTER CENTER-PUNCHING BOTH ENDS OF WORK HOLD IT ON CENTERING PIN AND PROCEED TO CENTER-DRILL UPPER END



Drilling ends of shafting

SECTION OF ANGLE IRON SERVES AS SAFETY STOP WHEN DRILLING LIGHT WORK IN THIS POSITION



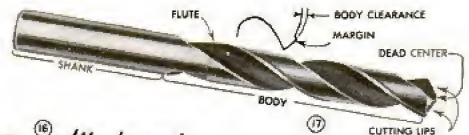
Safety stop

It is poor practice to whack a wobbling drill with a wrench or other tool as shown above. Although the cause may be a bent drill, other causes of this condition are ridges on the drill shank, an inaccurate chuck, or the drill may not be chucked properly. When drilling light work as in Fig. 15, provide a stop to prevent the work from swinging around as the drill breaks through

8790 Gt. Press Co 403
 London, Ont. N. Pittier,
 33 West 11th St.,
 at number 1188,
 Calumet, Mich.



Correct drill grinding



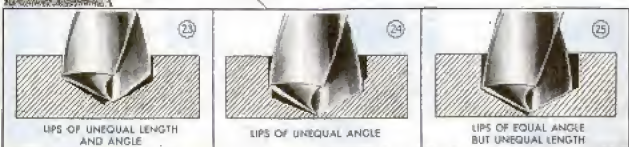
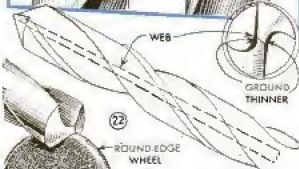
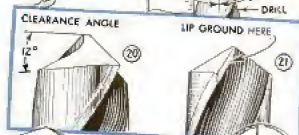
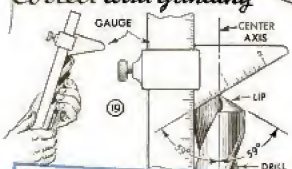
Attachment to sharpen drills

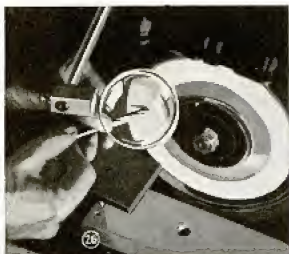


a wobbling drill with a wrench or other tool to straighten it while in the chuck as in Fig. 14. The condition may be a bent drill, its shank may have ridges caused by the drill sticking in work but slipping in the chuck, the chuck may be inaccurate and may need regrinding, or the drill may not have been put in the chuck properly. In production drilling on long slender pieces not clamped down, the drill is likely to catch in the

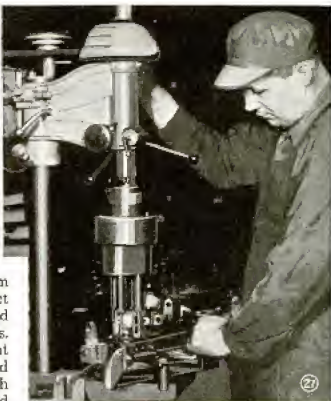
work when breaking through and may swing it around. Possible injury to the worker and tired fingers from gripping the work can be avoided by simply using a safety stop. It can be clamped or bolted to the table, or it may be a small piece of angle iron dropped into one of the table slots as shown in Fig. 15.

Sharpening twist drills: Fig. 16 shows an inexpensive attachment for grinding drill points, and Fig. 17 gives twist-drill nomenclature. When correctly ground, the drill will produce chips as in Fig. 18. For iron and steel, the angle between the lips of a drill and the center axis of the drill generally should be 59° , both lips must be of equal length, and there must be a clearance of 12° behind each lip. To test lip angle, you use a drill-grinding gauge similar to the one shown in Fig. 19, or you can make up a gauge for the purpose. Clearance angle behind each lip is indicated in Fig. 20. If this clearance is less than 12° , drills are likely to split along their center, and if the clearance is more than 15° the





cutting lips are apt to break down from lack of sufficient back support. Incorrect lip grinding produces oversize holes and greatly increases drill replacement costs. Figs. 23 to 25 inclusive show three frequent troubles resulting from incorrectly ground drills. In Fig. 23, lips of unequal length and angle cause the point to travel around the center of the hole. In Fig. 24, the lips are of unequal angle and one of them does practically all the cutting. In Fig. 25, the lips are of equal angle but unequal length causing the hole to become larger than the

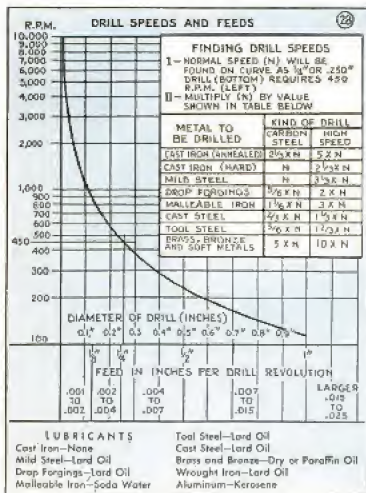


Four holes drilled at one time

drill, and one lip to take most of the burden.

When trouble is encountered in drilling hard material, first reduce the speed and then alter the cutting angle of the lips to 70° instead of the usual 59°. Next, grind a flat along each cutting edge as shown in Fig. 21, which reduces the rake angle of the lip. The same cutting point reduced rake angle is also best for drilling soft materials such as brass, copper and aluminum, where a regular point tends to grab or "hog in." The reduced rake angle gives the drill more of a scraping than a digging action.

Drill-point grinding by hand is not regarded as sound machine-shop practice but many machinists do an excellent job of this. It is done best on the side of a recessed 1 by 6-in. 46-grain, H-grade grinding wheel, turning at about 3,450 r.p.m. With a good hand support, the operator must learn how to hold the drill so that he can simultaneously reproduce the 59° lip angle and the 12° clearance angle. This is done by lightly pressing the cutting edge of the drill against the side of the wheel and while giving the drill a twist





to the right. It is surprising that green hands in a machine shop can master this practice in less than a week's time with an accuracy within $\frac{1}{4}$ degree. When grinding, wear goggles to prevent bits of metal flying into the eye, a practice that is often neglected but essential to the worker's safety. For small drills of $\frac{1}{8}$ -in. dia. or less, it is a great help to use a magnifying glass supported on an improvised holder while grinding, as shown in Fig. 26.

Drill speeds and feeds: Next to correct grinding, drill speeds and feeds must be right to avoid drill breakage and poor work. Average home-workshop drill presses have two four-step cone pulleys which give a range of speed from 600 to 5,200 r.p.m. for drills of $\frac{1}{8}$ to $\frac{1}{2}$ -in. size. However, an added jackshaft often is advisable to get greater speeds when using smaller drills than $\frac{1}{8}$ in., and lower speeds for drills over $\frac{1}{2}$ in. in size. By carefully studying the

chart and data contained in Fig. 28, you can ascertain the kind of drill to use on various metals, the proper speeds and feeds, besides the lubricants that should be used with different metals.

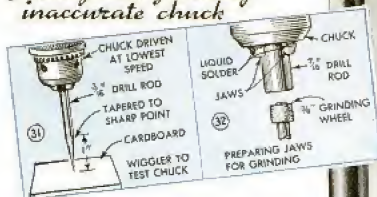
Attachments and jigs: In industrial work, it is necessary frequently to use attachments such as a multiple drill chuck, which drills several holes simultaneously. See Fig. 27. Also, a foot feed as shown in Fig. 29 helps to speed up production in many instances as both hands of the operator are free to handle the work. This photo also shows how a jig is used in production work. A jig is a device to hold duplicate pieces of work in exactly the same position for drilling one or more holes, hardened steel bushings in the jig serving the purpose of guiding the drill against the work without the necessity of the usual centerpunching. Where holes are tapped, a drill press fitted with a tap-



ping head is frequently located next to the one with which the drilling is done, as in Fig. 30. Tables giving drill-and-tap sizes are available at any machinists' supply house, and should be kept at hand for ready reference.

Inaccurate chuck jaws reground: When drill-press chuck jaws become inaccurate, they can be trued by grinding with the chuck on the drill-press spindle. To test a chuck for accuracy in this respect, you can use a wiggler as shown in Fig. 31; a perceptible wobble usually shows up any ec-

Testing and grinding inaccurate chuck



centric inaccuracy of the jaws. If they need reconditioning, slip a short length of $\frac{7}{16}$ -in. drill rod into the jaws, tightening them just enough to hold the rod yet allow it to be pulled out by hand. While the rod is so held, the jaws are glued temporarily to the lower edge of the chuck with a few drops of liquid solder in order to keep them in this position. See Fig. 32. When the solder has hardened, the rod is pulled out and a $\frac{3}{8}$ -in. portable grinder is set up on the drill-press table as in Fig. 33, in this particular case with an angle plate and a compound slide of a lathe. The assembly is placed on two parallel bars and is clamped to the table. Grinding the inside edges of the jaws is done by starting the grinder and running the drill press at its lowest speed. The chuck is lowered so that the grinder enters it, barely touching the jaws, and



then the grinder is advanced very slightly against the jaws. The depth of the jaws should be previously ascertained and the spindle depth gauge adjusted and locked so that the grinding wheel will not hit the bottom of the chuck.

Next month: The Metal-Turning Lathe

Trash Box of Lathe Easily Picked Up With Hand Truck

To simplify the work of moving trash boxes to and from lathes in a shop, one mechanic fitted the boxes with flat-iron pieces bent as shown and bolted in place. By pushing the bottom of a hand truck against the angle pieces and hooking it under the projecting lip piece, as indicated in the drawing, it is easy to lift a box and haul it away to be emptied.



Everybody Is an Inventor

Have you an easy, simple solution for one of those everyday problems around the house, garden, car, garage or workshop? Or, have you discovered a time- and labor-saving kink in photography, model making or other hobby? If so, just send a clear sketch or photograph and 50 to 100 words of description to Homecraft Editor, Popular Mechanics Magazine, 200 E. Ontario St., Chicago. We pay liberally and promptly for all accepted articles.

"Caliper" Steps Off Plow Lands Accurately in Field



Laying off plow lands or making quick field measurements in feet, yards or rods

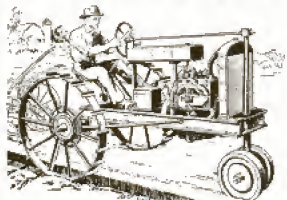
is no job for one farmer who uses this adjustable caliper. It is made from light pine strips riveted together near the top. In use, you simply walk in a straight line across the field, swinging the caliper over and over in a rolling motion so that the points touch the ground alternately.

Soiled Eggs Cleaned in Sand

If a pan of coarse, damp sand is kept at hand, it may be used to scour eggs, which have been soiled. Produce merchants often discount eggs that have been cleaned by washing, as the shells always show an unhealthy gloss. When scoured in sand, they preserve their natural appearance.



How to Build a Farm Tractor in Your Spare Time



Having plenty of power to pull a two-bottom plow and other implements, this farm tractor, built from old car parts, includes a Ford model-A motor and twin transmissions giving six speeds forward. Wrenches, hacksaw and drill are about the only tools needed—welding can be done at your local machine shop. Set of three 17 by 22-in. plans, Nos. 1024 to 1026 incl., containing construction details and material list will be sent postpaid upon receipt of 75c.

OTHER BUILD-IT-YOURSELF PLANS

STREAMLINE FAMILY TRAILER—937 to 942: Includes all the conveniences of home with sleeping accommodations for four. Trailer is 15 ft. long and weighs approximately 1,400 lbs. Six prints \$1.50.

UTILITY TRAILERS—986 and 987: Built of old auto parts and lumber. Adaptations of body to suit various purposes. Two prints 50c.

ELECTRIC SPOT WELDER—891 and 892: Works on 110-volt, 60-cycle alternating current. For small work up to 1/8 in. in thickness. Two prints 50c.

ELECTRIC ARC TORCH—106: Carbon electrodes 1/8 in. dia. produce arc for soldering, brazing, light welding. For 110-v. 60-cycle a.c. 25c.

LAWN CHAIR—529: Plain-sawed Southern style. All parts 3/4-in. stock. Easily made with hand tools. 25c.

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LAWN CHAIR ON WHEELS—978: Light in weight and easy to wheel to any location. 25c.

DUTCH WINDMILL FOR GARDEN—890: Excellent place to store garden tools. 10 ft. high, 54 in. in diameter at base. 25c.

Order plans by number and title. Send 3c stamp for new catalog of popular handicraft plans

Address Plan Service, Popular Mechanics Magazine, 200 E. Ontario St., Chicago, Ill.



Radio

AUTOMATIC LINE-VOLTAGE REGULATOR

By S. Gordon Taylor

ABNORMALLY wide line-voltage variations in many localities interfere with the efficiency of sensitive broadcast and short-wave receivers. A simple and inexpensive automatic means for maintaining the voltage more nearly constant can be assembled on a small wood base. It consists of a booster transformer capable of providing about 20 to 25 volts boost, with 3 secondaries of 7.5 volts each at 3 amperes; a suitable "Amperite" voltage regulator tube, a 4-prong socket and an output receptacle. See Fig. 1.

The tube is a resistance device which operates to reduce excessive supply voltages and is the heart of this automatic control. They are standard in current ratings, as shown in chart Fig. 4 which is used for selecting the correct regulator tube type for any given value of normal load current.

To determine which type of voltage regulator tube to use with your particular receiver, it is only necessary to measure the current drawn by the receiver load at normal 115 volt input. If an

(Continued to page 182)

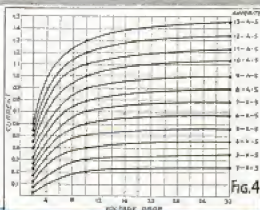
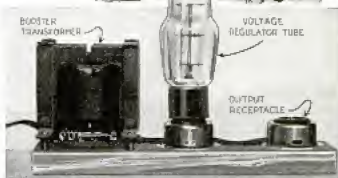
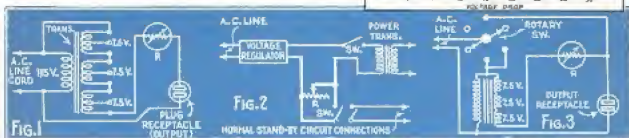
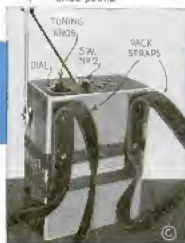
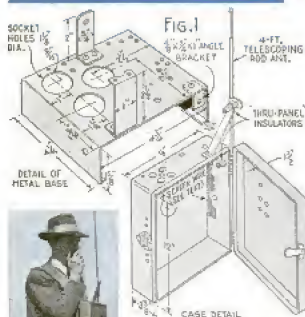
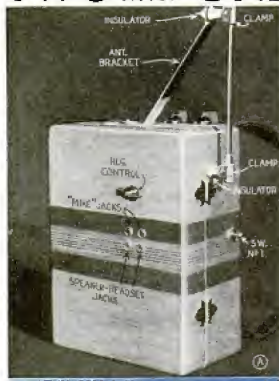


FIG. 4



TWO and ONE-HALF METER

By Stanley Johnson

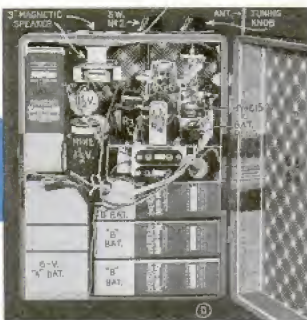


FITTED with pack straps, a rod-type antenna and self-contained batteries, this compact 2½-meter local-range transceiver is designed for emergency defense communications when, and if, such home guard operation is authorized. Thoroughly tested before December 7th, it proved to be a practical and easily portable means for highly satisfactory short range work.

Completely housed in a case made from a 59-cent overnight bag obtained from a "10-cent to \$1.00" store, there is ample room for the chassis, A and B-batteries, and even a 3-in. magnetic speaker. The metal base and case details are given in Fig. 1. With machine screws and nuts, bolt on the web carrying straps. These pieces of 1½-in. heavy webbing 38 in. long are lapped over 4½ in.; one of the lower bolts will go through the angle bracket fastened to the metal chassis base. Mount the 3-in.

speaker in the top of the case, using a piece of screen wire to protect the cone directly under the group of ¾-in. holes. Extend this screen wire across and down the side to serve as a "panel" to eliminate hand capacity while tuning. Next mount the thru-panel insulator on the side for the 4-ft. rod antenna, which is braced by a 7½-in. bracket and insulator as detailed in Fig. 1. Drill the control holes in the case when you have the chassis completed and ready to install.

The exact placement of parts is not im-

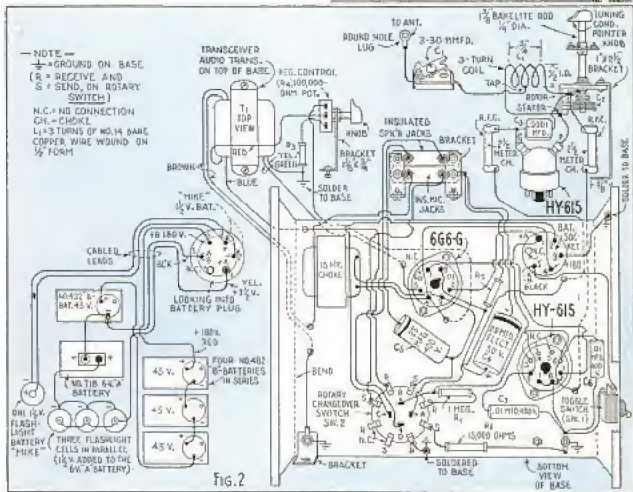
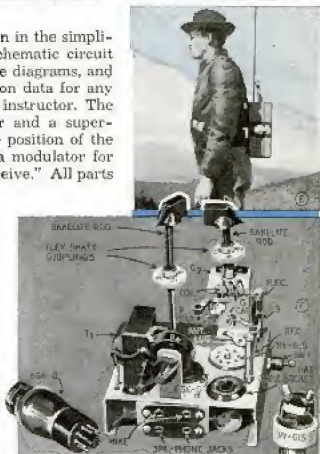


Emergency "WALKIE TALKIE"

portant, so long as the general layout shown in the simplified wiring diagram Fig. 2 is used; the schematic circuit diagram appears in Fig. 3. A study of these diagrams, and photos A to H, supply complete construction data for any licensed operator or experienced classroom instructor. The HY-615 tube serves as both an oscillator and a super-regenerative detector, depending upon the position of the changeover switch; the 6G6-G serves as a modulator for "send," and as a power audio stage for "receive." All parts are standard and clearly indicated.

Care should be taken in wiring the high-frequency oscillator and detector. The tube is mounted so that the two "caps" are very close to the ceramic-insulated tiny variable condenser (C_2) which is a Hammarlund 15 mmfd. type HF-15. Keep the grid and plate leads extremely short. The ends of the 3-turn coil go directly to the rotor and stator of (C_2). The stator is also wired with a very short lead which goes to the plate cap on the tube; the rotor is connected to a small .0001-mfd. mica fixed condenser (C_3) which is wired to the grid

(Continued to page 180)

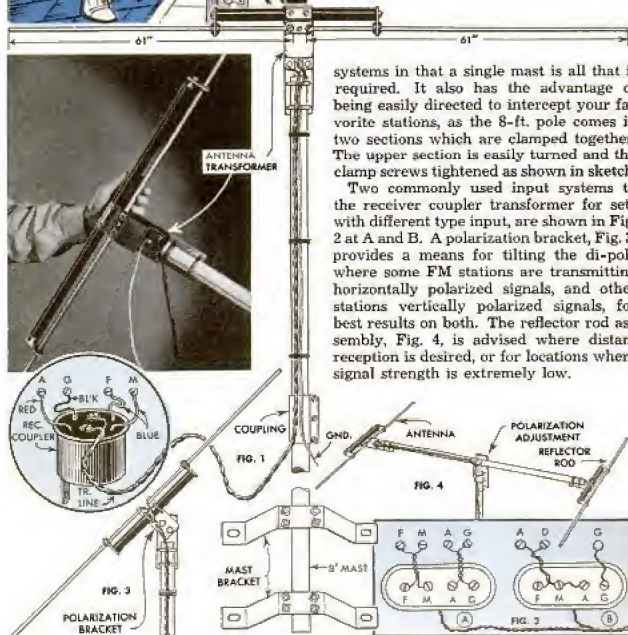


Technical Appliance Corp Di-Pole Frequency-Modulation Antenna System



FOR the best interception of FM programs, now available within a radius of from 25 to 50 miles around many large cities, a di-pole antenna similar to a television antenna is recommended. The installation is comparatively simple as the reflections encountered in television reception do not as a rule cause any noticeable interference with FM. Owing to this fact, reflectors are seldom required.

The frequency-modulation antenna illustrated is a "Taco" di-pole type that not only gives maximum results on FM but also provides for the reception of standard AM broadcast and short-wave bands. A short, rigid di-pole assembly, see Fig. 1, has the advantage over long wire antenna



systems in that a single mast is all that is required. It also has the advantage of being easily directed to intercept your favorite stations, as the 8-ft. pole comes in two sections which are clamped together. The upper section is easily turned and the clamp screws tightened as shown in sketch.

Two commonly used input systems to the receiver coupler transformer for sets with different type input, are shown in Fig. 2 at A and B. A polarization bracket, Fig. 3, provides a means for tilting the di-pole where some FM stations are transmitting horizontally polarized signals, and other stations vertically polarized signals, for best results on both. The reflector rod assembly, Fig. 4, is advised where distant reception is desired, or for locations where signal strength is extremely low.

Practical RADIO HINTS



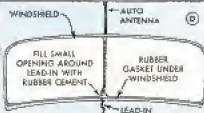
(B) Air-drying finish for microphone stands and instrument panels produces a neat hammered metal effect. The finish is a 2-coat process and comes in eight colors



(C) Adjustable belt speeds up dial repairs. It is put on without taking the dial apart; a zipperlike fastening makes instant connection. (E) Cementing loose tube bulb in base

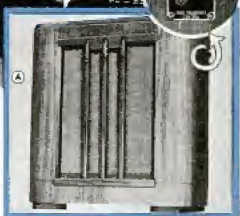


(A) "Across the room" high-fidelity speaker for use with FM and AM receivers. This extension reproducer unit has two separate coaxially mounted speakers for low and high frequencies, and is provided with a high-frequency range control adjustable for maximum results on each program; see inset photo

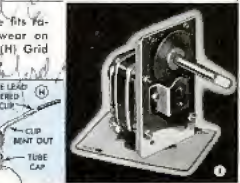
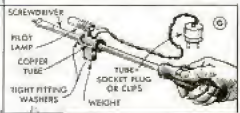


(D) Waterproofing auto-antenna lead-in on car with divided windshield, where lead-in runs into car under rubber gasket between the windshield and car body. Prevents leaks during driving rains

(F) Two-partition leather tool case fits radio worker's hip pocket; saves wear on packets and keeps tools handy. (H) Grid cap made from pencil clip



(G) Pilot lamp mounted on a piece of tubing fits loosely over screwdriver and provides light when working in large receivers. (I) Miniature motor for intermittent duty. Operates on 60-cycle a.c., and permits instant reversal by switching one lead



Alfred Radio Corp. 8330 Broadway Chicago Sound System Installed Quickly



Designed for rush public address jobs, this compact 30-watt sound system includes fold-down tripods for mounting the speaker cases, and comes with all necessary cables for instant operation.

Semi-Synchronized Sound Effects

This twin-turntable phono amplifier provides incidental sound score and back-



ground music with your silent films! Stroboscope control keeps record and projector in close synchronization at all times. Each 16-in. disk allows sufficient time for 400 feet of 16 mm. film.

"Flyweight" Portable Receiver

Extremely light in weight and of small size, this 6-tube miniature broadcast receiver is housed in a compact case provided with a "roll" front which completely covers the controls and metal grill for portable purposes. It has a built-in loop antenna, and provision is made for using a separate detachable antenna.



Power Resistor Decade Box

Capable of handling real power so that it can be inserted in actual receiver circuits to simulate working conditions, this decade



box speeds the selection of correct resistance values for any circuit or condition. The range is from 1 ohm to 999,999 ohms by means of 6 decade switches on the panel.

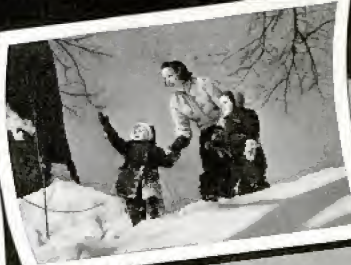
Blueprints covering simplified radio construction articles in this and past issues are available for 25c each. Many popular tested circuits to choose from. Original detailed parts lists with names of supply sources, can be obtained from Popular Mechanics Radio Department upon receipt of postage.

NEXT MONTH—A One-Tube A.C.-D.C. Emergency Pocket Receiver. Just a few standard parts and a small cigar box are used to build this practical broadcast set that you can tuck in your pocket when traveling, or use in the home, office or plant for important broadcasts. Also—A Homemade 3-Circuit Tuning Coil.

WINTER SNAPS ARE SIMPLE...SURE

*Isn't this a
swell snapshot
to get on a winter's
day? We used our
regular summer-
time film—*

KODAK VERICHROME



*...and here's a
sample of the
grand snapshots
we've been
getting indoors
at night—using*

KODAK SUPER-XX



OUTDOORS—Use Kodak Verichrome Film for your outdoor pictures this winter. It helps overcome small exposure errors, extends the "snapshot day," lets you get swell snapshots even when the weather isn't just right.

INDOORS AT NIGHT—Super-fast Kodak Super-XX Film gives outdoor excellence to indoor pictures. Use it with Photoflood bulbs and cardboard reflectors. BOOKLET FREE AT YOUR DEALER'S. Also covers flash pictures... Eastman Kodak Co., Rochester, N. Y.



OUTDOORS...INDOORS...you can always count on KODAK FILM

Gateway to the World

(Continued from page 43)

210 24.
turies, enough for a person traveling 30 miles an hour to make seven round trips between the earth and the sun. Tolls paid by drivers during the past year on Port Authority crossings exceed \$15,000,000.

Increased efficiency has been due to the employment of labor-saving mechanical devices. The Port of New York has more modern freight-handling machinery than can be found in any other three salt-water ports in the United States. The port's heavy lift equipment includes many fixed cranes, a fleet of derrick lighters and gigantic floating cranes. Floated direct to shipside, one derrick has lifted such monster items as sixteen-inch coast-defense guns—one hundred sixty-five tons poised in perfect balance; a sixty-ton steel bridge girder, and a complete oil storage tank without dismantling. Four derricks lashed together have transported a bank of thirty-six conduit pipes, almost a block long.

Pier loading mechanisms include tractors, power-driven lift trucks and lumber carriers which move along the piers and shuttle back and forth between shipside and transit sheds and warehouse. Many units are equipped with prongs, forks and small hoists, to lift special types of cargo.

Like motor trucks on land is a flotilla of local harbor boats which speeds shipments between the various areas. These barges, scows and lighters are like heavy-duty water trucks delivering fuel, building supplies and general merchandise.

Functioning like the horse on land are six hundred husky tugboats which tow lighters, barges, carfloats and other floating equipment not self-powered. Some seventy-five tugs move from pier to pier, maneuvering liners in and out of their berths. Many have two-way ship-to-shore radio. The tug fleet includes Diesel electric-operated, streamlined, modern craft.

For the handling of valuable cargo and other non-bulky commodities are fast self-propelled lighters, which need no tugs. Equipped with derricks, these lighters load or unload at shipside and carry cargoes to rail connections, assuring a quick interchange of goods between land and water.

Strangely, the port, which is really a number of ports, has tended to specialize according to locality. Each of the eight large bays, Jamaica, Upper, Lower, Rari-

tan, Gravesend, Newark, Flushing and Eastchester has a distinct character of its own. So have the four rivers, Raritan, Passaic, Hackensack and Hudson and the four straits, Harlem River, East River, Arthur Kill and the Kill van Kull. In several of these waterways ports like Antwerp and Hamburg could be hidden away and hardly noticed, yet none is a complete all-purpose port in itself.

At Port Newark, 45,000,000 board feet of lumber are unloaded per month and warehouses can store 10,000 fully loaded freight cars. This is a center for the rail-to-keel service of four large railroads. Shipbuilding is Kearney's specialty and 10,000 men worked in its yards before the war-time emergency grew to its present size. Bayonne has a drydock large enough to lift the largest naval vessel ever constructed. It also has the largest concentration of oil refineries and storage tanks in the East. Hoboken is the base of some of the nation's largest lines of freighters, including sea-going car ferries which ply to Havana, New Orleans and Texas City, where fully loaded freight cars are lifted from the holds of the ships and set down on tracks to continue to their destinations.

Staten Island has long been known as the terminus for products from the far East. It is also a shipbuilding center and, since the emergency, loads huge quantities of war-zone cargo. The Bronx acts as a feeder to the Island of Manhattan with power plants, coal depots, asphalt works and gypsum plants.

And finally there is Brooklyn which handles nearly one-fourth of the entire traffic volume of the port with 34 steamship piers, 8,000,000 square feet of storage and industrial space on its docks and its own waterfront railway. Behind the waterfront are more than 100 more storage buildings. And still there is room for one of the world's great navy yards.

Typical of the precautions being taken to guard this "gateway to the world" is the daily minesweeping operation. Fleets of stubby little vessels ply back and forth, searching the harbor for explosives that some enemy warship might have laid. In addition, there are numerous devices designed for protection of the harbor against hostile submarines and other craft.

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You'll love it!

YO HO! AND THE FLAVOR OF RUM!



The Race Horse Goes to School

(Continued from page 59)

tempts to mount. Such is not the case. Usually the trainer he knows stands at the head and speaks soothingly, while someone else the horse is familiar with quietly mounts. The animal is surprised, but if he has been properly trained he will offer little resistance. If he has not been properly trained—look out! No wild mustang from the western plains can equal him if he wants to buck. He may go so high on his hind legs that he will fall over backward; he may lie down and roll over so quickly the rider cannot get free; he may start to run with all the speed generations of breeding have given him, and fences, trees, obstacles are just something to crash into.

Wild demonstrations are the exception rather than the rule, however, and if a horse indulges in one at the outset, he may be an outlaw all his life. But usually he is just a little surprised, and quickly pacified when his friend gets down after a few moments. Gradually he accepts the idea that this is all right, and his affection for the man—for all men—becomes stronger.

Sometimes with especially high strung horses, the trainers teach them to run beside another horse before attempting to ride them. Some older horse, often the colt's mother, is ridden while the youngster trots alongside, drawn by a halter.

When they have learned to carry a man, one more big lesson remains. That is how to behave at the starting gate. This was a terrific problem at the old style barrier, but the new gates prevent the horses from pitching and bolting, and since they are shut off by themselves, they have less tendency to get upset. First step is generally to lead them quietly through stalls until they get thoroughly used to the situation. Then they are led in with the gates closed, become used to the fact that the gates fly open quickly, and learn not to flinch. Then they are walked through the gates with a rider, and trainers they trust wait on the other side to quiet them. And finally they learn to dart forward the instant the gates fly open.

Now the really hard work begins. Every morning, they are up at dawn for training, which may last a few minutes to several hours, depending on the horse's condition. Clad in blankets, they are walked about a bit to limber up their muscles. Then a

rider mounts, and the walking continues. When the horse is thoroughly limbered, he is taken to the track for a run. How long and how vigorous the run will be depends entirely on the wisdom of the trainer. It may be a furious dash of several furlongs, or it may be just a slow jog to train the muscles.

If a horse starts to develop fears and inhibitions, headaches for trainers come thick and fast. Why does he suddenly bear out on turns, as if he wished to crash the rail? Is he afraid of something? Is he naturally an outlaw? Can he be made to behave? It takes patient work to answer these questions. Sometimes the men throw up their hands and admit failure. But here is a strange tradition: An outlaw horse is often one that can outrun everything on four legs if he can be properly disciplined; and almost always there appears a man who loves the animal, who sees his great possibilities, and by long hours of work helps him realize them.

The greatest bugaboo of the race horse has always been physical injuries. They are too fast for their own good, and their fighting spirit is so strong that they will drop dead in their tracks rather than quit. Of course, every important track and most of the large breeding and training ranches have a veterinarian in constant attendance.

An injured leg has always been considered well-nigh fatal to a horse's chances of becoming a champion. The injured leg had to be exercised, or the muscles would atrophy, and exercise aggravated the hurt. Many devices for removing weight from the bad leg have been tested, but it was only recently that trainers on the Pacific Coast thought of a new solution.

When the horse is in water, not much weight will rest on the injured leg. So the "convalescent" horses are ridden into the water at some nearby beach and allowed a bit of gentle exercise. The California beaches slope gradually out to sea, are notably free from rocks and holes, and so are ideally suited to treatment of this kind. The horses love to run in the surf, and the salt water seems to have an additional healing value.

¶To learn where to buy commercial products described in these pages, see the index.



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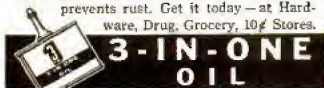
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It's All in the Swing

(Continued from page 59)

you may try swinging through a longer arc.

You may practice in your back yard, hitting a soft practice ball against the garage. Some players who know that the secret of success lies in much practice have turned their back yards into practice courses, with canvas tarpaulins hung up to stop a ball on long drives, and with a few putting holes cut into the lawn. Driving ranges are good places to practice. Many of them are illuminated for night playing. Players can rent a bucket of balls and practice for both accuracy and distance without leaving the tee.

Don't practice after your fingers get tired. Use the same rhythmic swing for each of the clubs. Even the putter is swung through its few inches of travel. As you gain experience you will learn to modify the length and speed of the swing depending on the lie of the ball and the distance to the green.

After you have mastered the fundamental swing you should spend just about as much time actually playing on a course as you spend in practice. Always play with people of your own class. If you go around with better players you are apt to strive too hard to make each shot perfect and your game won't improve as fast as it should. That's another way of saying that a good swing is an easy motion and that the minute you begin to strain and try too hard, you spoil it.

Of course, you ought to begin golf by taking a few lessons that will give you a picture of the whole game and that will teach you the rules. From then on, together with your practicing and playing, you need a lesson every month for the same reason that a singer continues to take coaching lessons even after he has become accomplished.

Good golf is an art that results from developing your sense of feel of the club head. You can't buy a sense of feel, so don't expect half a dozen lessons to make you a good player. That comes only with practice. Now go back and read this article all over again.

Look in the index to find where to buy articles described in this magazine. Say You Saw It in Popular Mechanics.

What to Do in a Blackout

(Continued from page 85)

sacks with dry sand and store them in a dry place, with a shovel nearby. Dry sand, carefully banked around and smothering an incendiary bomb, will not put it out but will reduce its action and keep its fire from spreading. Another way to fight an incendiary is with a fine water spray such as is produced when a garden hose nozzle is twisted to deliver a mist. Never direct a solid stream of water at an incendiary. This increases combustion so rapidly that the thing seems to explode. The fine spray, also, increases combustion, but at a slower rate, and helps the bomb to burn itself out and at the same time helps protect the material it is lying on. Have a ladder available so that you can reach roof fires.

If you are driving a car when a blackout occurs, follow the rules that have been laid down in your area. Even if your headlights have been painted blue you still probably will be required to park your car, turn out the lights, and seek shelter. Park against the side of the road if you can but in all events leave a lane clear in the middle of the street so that emergency equipment can pass. If you must leave your car near the middle of the street, leave the ignition key in the lock so that it can be moved if necessary. Don't seek shelter against a building where debris may fall on you. Get inside and stay away from windows. Windows that are opened are less apt to shatter from concussion.

Even if the local rules permit slow driving with all lights out, don't try it. Thousands of dollars worth of damage was done to cars and lamp posts in Los Angeles during its first blackout, when such driving was permitted, aside from a number of serious accidents. If you are walking, it is dangerous to cross streets, even with white or luminous clothes. Don't expect the driver of an emergency car who is using the tiny blue military blackout beams to see you. Such lights give him little illumination and are merely to warn you.

Another thing, don't take blackout enforcement into your own hands by smashing advertising or display signs that haven't been turned off. Sometimes an open circuit will cause a serious fire. Emergency switches should be provided that can be operated by air-raid wardens.

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IN CARS, TRUCKS AND TRACTORS

2127

although many navigation students have already learned to fly. During the course they spend 100 hours in a Beechcraft "flying classroom," before and after dark, learning to work out practical problems in navigation.

Sometimes a pilot takes up a group of students and purposely gets "lost." Then it is up to the students to find out exactly where they are and work out the course for returning to their base. As one practice stunt, navigation students from three wide-



On the fuselage of a "flying classroom" a student inspects the streamline housing of a radio compass

ly separated fields recently took off after dark and by keeping track of each other's position by radio were able to rendezvous at 10,000 feet over strange country and then fly in formation to a fourth field.

Basically, aerial navigation is the same as marine navigation but a marine officer can take his time in working out his position, while even a 10-minute delay in the air may be serious. The men in a plane must know where they are at the present instant instead of where they were 50 or 75 miles back. Automatic computers and overgrown slide rules have been developed so that navigators can find a position with a few simple computations instead of working out long problems.

Thirty thousand new pilots a year could fly a tremendous fleet of airplanes and even this great training program may be increased in the near future. Fortunately, America has no dearth of young men who will make capable pilots. One authority estimates that there are half a million American youths who have the qualifications for becoming excellent pilots.

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(Continued from page 37)

scores of cables; the largest is more than seven feet wide and eight feet high. If a break in the sheath occurs and the cable is accessible, the trouble usually can be located immediately. Inert nitrogen gas is forced into the cable, the splicer applies soapsuds to the surface of the cable and bubbles of escaping gas show up the leak.

Many important cables are kept under protection of a nitrogen gas pressure alarm system. The instant pressure falls below a certain level, as a result of breaks in the sheath, an alarm sounds in a service center.

The electrical impulses that flash over the city's underground wires carry a miscellaneous burden of radio programs, radiotelephone conversations, Teletypewriter messages, and even pictures. Special circuits for music are provided in underground cables to link radio stations. In ordinary telephone conversations the tone frequencies to be transmitted are relatively narrow, but a wide range of frequencies is needed to transmit the music of an orchestra or the voice of a singer. To provide a wire system to transmit music, it was necessary to equip cable circuits with special loading coils—devices which keep the voice and music-carrying waves from dying out—approximately every half-mile. Special broadcasting wires were built into new cables, with amplifying or repeater equipment at frequent intervals.

New York's cables are also an adjunct to overseas and ship-to-shore telephone service. The voice goes by wire to one of several transmitters in the vicinity of New York, where powerful vacuum tubes hurl it into space. The voice coming from across the water, from another land or from a ship, is not received at the transmitter point, however, but at a distant receiving station. From the receiver it is fed into land lines to the control center at New York and thence to the listener. The world-wide telephone neighborhood, when not affected by war restrictions, is made up of more than 75 countries, with more than 41,000,000 telephones.

It is almost as easy to call San Francisco from New York as to phone the corner drug store. The human voice can fly from coast to coast in one-twelfth of a second,

(Continued to page 172)

WET CELLARS MADE DRY from the Inside!

WHERE water or moisture seeps in through cracks or porous spots in the cellar floor or walls, you can make and keep your cellar dry and sweet by filling the cracks and coating the moist surface with Smooth-On No. 7.

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There is no substitute for quality and reputation, and Champion Spark Plugs are true "Champions" the world over. Champion spark plugs are backed by research, experience, and engineering resources without equal.

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almost the speed of light itself, so that the voice of a business man in New York reaches the Pacific coast quicker than the voice of a woman can reach her friend across the street if she calls out the window.

One of the latest improvements in long distance telephony is the coaxial cable. It contains only two conductors, yet from 240 to 480 simultaneous conversations can be held. The conductors are copper tubes about the size of a pencil, supported at intervals by small, circular disks of non-conducting material. The talking circuits are really two-way, wire-directed radio voice channels. Each tube confines a bit of segregated ether into which the voice-carrying waves are poured at one end, and strained off, or unscrambled at the other.

Huge cable-laying mechanisms, drawn by Caterpillar Diesels are plowing under new lines across the country to keep pace with the spurt in long distance communications needed by the armed forces and the expanding war industry.

But most of the new volume of telephone service in New York City, is made up of local phone calls. Counting these millions of calls was another achievement of telephone engineers. Each metered telephone now has a spot of mechanism on a large board and each spot has an electrical counter which operates only if the call is completed. Each month the panels are photographed by sections, and girls, reading the figures on the counters as shown in the photos, make up the customers' bills.

One problem still baffles the telephone scientists—to eliminate the millions of "hellos" from the conversations. Answering the phone with "hello," is a loss of time and adds more to the length of a call than science may ever be able to subtract.

Model Builders Attention!

	V	V-2	V-3
Hex	1/2"	3/8"	5/16"
Thread	3/16"-24	1/8"-32	1/4"-32
Thread Length	7/8"	7/8"	3/4"
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Wings for Freight

(Continued from page 15)

primarily for passengers. Cargo space is limited. The problem, then, is to develop aircraft and methods of handling cargo that will permit even lower tariffs.

In 1940, about 86.9 percent of the domestic air express traffic was handled by American Airlines, United Air Lines, Transcontinental and Western Air, and Eastern Air Lines. Recently, these four formed Air Cargo, Inc., to survey the potentialities of the cargo field—aircraft requirements, traffic flow, markets, tariffs, all factors pertinent to efficient operation.

After this war, civil aviation will develop at such a pace that instead of 235 airports now served by our air lines there will be a thousand or more with scheduled service. A huge surplus of military aircraft will be disposed of for commercial use. Big bombers undoubtedly will be available for cargo transportation. An air cargo system offering a five- and six-hour service to every section of the nation, Canada and Mexico, will place industry at the source of many materials; factories can be located near cheap power and airports quickly constructed to provide air service.

Shipments weighing 200 to 600 pounds are being transported by air express today. Heavier shipments are handled by special arrangements, and plane-load lots of 3,500 to 5,000 pounds are not uncommon.

The average person conceives of air express as a sort of stunt service by which perishables, from foodstuffs to a movie star's lock of hair, are sent by air just to get attention. Such shipments are handled, but air express also functions as a vital arm of the world's communication system. For example, 30 electric heating units for an Australian steel company were shipped by air from Buffalo to "down under." Without air express it might have taken three to four months to effect delivery. By air, the shipment traveled by American Airlines from Buffalo to Los Angeles, by Clipper to Sydney, Australia, and by Tasman, Empire Airways, Ltd., to Waratah, N. S. W.

From Chicago, an air liner carried a 600-lb. roll of cable to Texas, to be used in connection with a new Air Force training school. When a big motor broke down in a west coast plant, armature windings

(Continued to page 174)



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weighing nearly 3,000 pounds were rushed by plane from the east. Dies, tools, crankshafts are being flown to keep the war program moving at top speed. Blueprints, data, orders, travel between Washington and war factories in a few hours. In World War I the same shipments required days. In Alaska, mining equipment is flown into location. Livestock frequently is air-shipped in our neighbor countries to the south. The role of air express in speeding serums and medicines into areas stricken by flood and fire is well known. One laboratory furnishes serum to the U. S. Navy on a 24-hour basis by air express. Producers of wearing apparel are the largest users of air express. Newspapers, cut flowers, perfume, jewelry, financial reports, cancelled checks, gold, rubber sponges; well, you name it and chances are it goes by air.

It was back in November, 1910, that the first air express shipment, a bolt of silk weighing 22 pounds, was carried from Dayton, Ohio, to Columbus, in a passenger's lap. In November, 1940, just 30 years later, the largest air express shipment in history, 36,000 pounds, originated in the same city. It was a magazine's election issue.

Commodities carried by air express have been unusual, as well as commonplace. Bette Davis, the screen star, received a New England dinner, boiled in Boston, by air at Hollywood. What were claimed to be the ashes of Columbus were shipped by air from Los Angeles to New York. The season's first catch of trout from a New Hampshire stream was sent by air to President Roosevelt. A Chicago bakery, interested in a new oven, forwarded to New York by air a case of unbaked pies. These were baked in the oven under consideration, air-expressed back to Chicago, tasted and the decision made.

Planes brought 500 pounds of rubber seeds from the Dutch East Indies to Dallas.

A Chinese in New York had a stomach ache. Remembering an herb remedy in China, he decided these herbs must be gotten from his native land. He got them. They were packed down the Burma road, sent by ship to Hong Kong, by clipper to San Francisco, by plane to New York—a distance of 11,000 miles at a cost of \$4.99.

The longest air express shipment flew 18,000 miles from New York to Cairo, Egypt. It was a box of sample uniforms for the British Middle East Command.

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Outwitting the Saboteur

(Continued from page 31)

crimp shut the fuel line of a training plane with pliers, causing the plane to crash soon after it has taken off. It's just as easy to catch the malefactor if you know how.

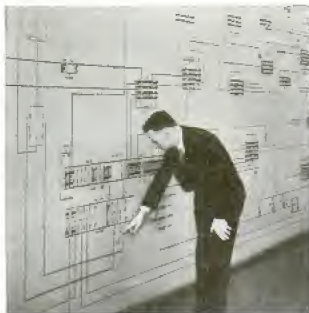
No two pairs of pliers are exactly alike under the microscope, Wolfe explains. Each pair leaves its individual signature just as the rifling of a gun leaves its particular mark on a bullet. Thus, the plier marks on the crimped fuel line from the

versive agents to tie such plants up. Sometimes the weakness is an outside water reservoir that supplies the plant, and is forgotten and unguarded. Suppose someone dumped sacks of cement into it some night to clog the outlet, possibly a few hours before a fire in the plant was to be set off. Such reservoirs should be illuminated, and their drainage lines protected by large bulging grilles.

A saboteur doesn't need to pass through the gates if a plant's electrical transformers are out on the street, where they often are. He can shut the power off and possibly put the transformers out of commission if they are within reach of his throwing arm. Again, watchmen are no protection if they patrol their beats at regular, predictable intervals. Watchmen's tours should be on a varied schedule so that no one can tell when or where they will next appear.

Protective systems such as burglar alarms or fire fighting apparatus should be put to use now and then to make sure they work. Such tests may reveal unsuspected faults, as was the case when firemen insisted on pretending there was a bad fire at a new shipyard. A six-inch water main served all points in the yard but when the firemen attached their lines and opened the hydrants, hardly enough water to quench a pile of burning rubbish flowed out. Fire apparatus would be useless if a real blaze started. Tracing down the trouble, it was found that the six-inch main was connected to the city water supply through a two-inch coupling. Fortunately the mistake was found and corrected before a real emergency happened.

"One way a subversive agent gets by guards and fences is by intimidating an employee," Wolfe says. "Bribery is relatively out of date; what a saboteur prefers is to find a hidden 'skeleton' in the history of some key employee and then through threats of exposure force the man to reveal secrets or participate in wrecking. When a trusted employee suddenly becomes depressed and nervous and seems to have a hidden fear, someone should find out what is on his mind. The chances are he will be merely run down or worried about his family, but it may be that he had been subjected to such threats. These days it doesn't pay to take chances."



Dispatcher at switchboard where power can be shunted around section of system damaged by sabotage

wrecked plane can be compared with pliers used by every man who had access to the plane. If one man's pliers are missing, that is enough to fasten suspicion on him. If none of the pliers agree with the markings on the fuel line, someone brought an extra pair to the field and there are other ways of tracing their ownership.

It is better to prevent sabotage than to be a genius at nabbing suspects after the damage is done. Wolfe reminds his classes of the story about Napoleon, who is said to have put half the Paris police force at work scheming to assassinate him and the other half at work making certain such schemes could not succeed.

With a little imagination, many of the loopholes for the saboteur can be closed. Wolfe points to some industrial plants that were thought to be foolproof simply because all employees had been fingerprinted and armed guards patrolled the fenced property. There still may be ways for sub-

Enlisted

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ON AMERICA'S FRONT



APRIL, 1942

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Super Camera of the Skies

(Continued from page 53)

will be coated with a thin, bright layer of aluminum. Then it will be crated and hauled 80 miles by truck at six miles per hour to a permanent place on the mountain.

A large telescope does not merely gather a lot of light. An equally important property is its gain in detail, structure, or the quality of the image that it forms. This property is called resolving power. The naked eye with its quarter-inch pupil can

The big instrument will be effective for many generations. The problems already laid out for it will be uncompleted a hundred years from now. New problems not yet contemplated may push some of them aside. The results will be available to everyone. By such traditions astronomy has been the most fruitful of all sciences. It has mothered agriculture, navigation, geography, mathematics, physics.

From the visitors' gallery in the great 137-foot dome the public respectfully watches the astronomers set up the equipment for the night's work with no desire to get closer, where they might impair the instrument with their bodies' heat or dust from their clothes. The results will belong to everyone and no individual will interfere with progress just to satisfy his personal whim or curiosity.

There is a moral in that. Research is becoming more and more a cooperative enterprise. Whole crews of men participate and collaborate. They are ordinary fellows like everyone else. Yet they don't have any idea of getting rich. They work as hard as they can. I believe that as they pause sometimes during their work and glance at the visitors on the other side of the glass wall in the observatory dome, they feel that the public, for whom after all their work is being done, is entitled to the best.



Photo by O. K. Harter

Its eye open to the skies, part of the telescope shows through the open shutters of the observatory dome

read newsprint three feet away. With the 200-inch telescope, in a quiet atmosphere, we could read the newspaper a half mile away—800 times as far. Only a circle about five columns wide would be sharp. To read other parts they would have to be brought into the center of the field of view. In an astronomical picture made with the great telescope only the central inch of the plate will be of high quality. Yet there might be 100,000 star images in that part of the picture.

The gain in light of the 200-inch mirror over the naked eye is more than half a million fold. The telescope will thus be by far the most powerful camera in the world. Many of the stars to be photographed are many times brighter than the sun, yet so far away that exposure time will run into hours. Meanwhile the ceaseless churning of the atmosphere, imperceptible in smaller instruments, makes it a grueling task to hold the telescope on the object. The best of weather is still too unsteady to make it worth while to try a telescope larger than this.

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Any possibility of packages bouncing out of the luggage basket of your bicycle can be avoided by using this simple boom. It consists of three wood or metal strips assembled in the shape shown and held in place by coil springs. These run from the ends of the cross strips of the boom to the bottom of the basket. The upper ends of the springs hook into screw eyes or into holes, making it easy to remove the boom for filling the basket.

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(Signed) *Ken Davis*

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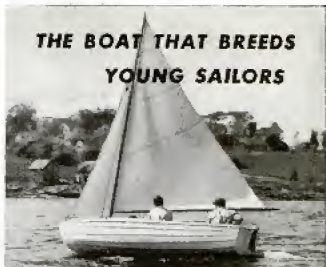


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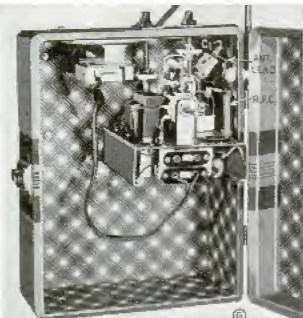
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the dial; however, the 2½ meter band will be found with (C₂) from ½ to ½ open. One of the special combination handsets with 2,000-ohm phone may be used if desired. In the final assembly, tap the antenna trimmer condenser (C₁) on the coil, 1¼



turns from the "plate" end. Adjust the capacity until super-regeneration becomes erratic, then decrease the coupling slightly. Condenser (C₆) is critical in value, a slight change in layout can upset this value which will vary between .002 mfd. and .01 mfd. Blueprint number for this article is R-302.

Line-Voltage Regulator

(Continued from page 155)

a.c. ammeter is not available, a 1 or 2-ohm resistor can be connected in series with the load and the a.c. voltage drop across it measured; dividing this voltage by the resistance will give the current. The "Amperite" number at that current value is required for this particular load. This tube serves as an automatic check valve.

Fig. 2 shows the voltage regulator in stand-by operation, in connection with other apparatus, by means of a D.P. switch. To compensate for wide variations in load current resulting from this operation, an adjustable wire-wound resistor is installed as shown by the heavy lines. When the switch is thrown to stand-by position it automatically inserts the compensating resistance. Another suggested line-switching arrangement, shown in Fig. 4, employs a 6-contact 3-position switch.

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Science Looks Ahead

(Continued from page 4)

resulting from light striking glass. A long stride has been made toward eliminating that by development of an ant glare treatment. The glass is placed in a large, high vacuum metal globe, then a tiny bit of magnesium fluoride is electrically evaporated, coating each surface with a film 1/300,000 inch thick. After the glass has been coated, the chemical films are hardened by heat and waterproofed.

In another field, extremely thin films of synthetic resins, some composed of only 10 to 15 layers of molecules, are proving a useful tool of science. The thinnest films are employed in mounting specimens in the electron microscope, which uses electrons in place of light rays and has magnifying powers of 30,000 diameters or more, many times as powerful as the best light microscopes. Somewhat thicker films are valuable in studying characteristics of the resins. For instance, the effects of ultraviolet light can be shown in a few minutes, whereas hours are required with other methods. Another possible use of the films is that of "beam splitters" in optical instruments after the films have been treated with zinc sulfide. In the instruments, the beam splitter is employed where it is desired to divide a light beam, reflecting part to the side and sending the rest on its original course. Partly silvered mirrors are usually used, but these lose about one-third of the total light; in contrast, only one-twentieth of the light is lost with the films. The thinnest resin films are about 1/2,000,000 inch thick.

No one dares to guess how important to man will be the "cosmic ray generator," devised by Dr. Donald W. Kerst. Promising results already have been obtained with a machine capable of developing only one-fifth of the energy which will be available to scientists using the 100,000,000-volt generator under construction in the General Electric Research Laboratory. In the smaller machine, which Dr. Kerst calls the "Betatron," electrons—the smallest negatively charged particles—are accelerated to the highest speed ever produced by man-made apparatus. It gives these particles energy corresponding to 20,000,000 volts and also produces X-rays of this

(Continued to page 186)



TESTS DISCLOSE INTERESTING FACTS ABOUT WRENCHES



When Williams developed an improved type of carbon steel wrench, many different patterns of these tools were given exhaustive strength tests. Williams' engineers discovered some startling facts: these "Superior" Wrenches, as they are called, were nearly twice as strong as old-fashioned carbon wrenches; they averaged 93% as strong as the strongest alloy wrenches . . . in fact, were actually stronger in certain cases where corresponding patterns were compared.

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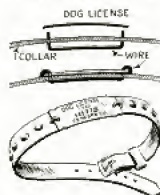
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power. The magnet of the present machine, now at the University of Illinois, is only five feet long, three feet high and two feet wide—a midget when compared with the apparatus employed in the towering machines previously used for accelerating electrons.

A doughnut-shaped glass vacuum tube, between the poles of a large electromagnet, is the heart of the Betatron. Electrons from a hot filament within are whirled around the tube and steadily accelerated by electromagnetic forces until they attain a speed closely approaching 186,000 miles a second, that of light. Magnetically guided, the electrons collide with a metal target. This collision results in production of X-radiation equal in intensity, as determined by ionizing power, to the gamma radiation in a corresponding beam from more than 1,000 grams of radium—more than the world's existing supply.

This smaller machine has produced radiations which have made copper radioactive—a transmuted form of the metal which for a few minutes has some of the characteristics of radium. In addition, electrons have been given sufficient velocity to penetrate an inch of aluminum. Apparently the effective voltage of the Betatron can be increased indefinitely; hence the decision of General Electric scientists to build the larger machine which is expected to impart energy corresponding to 100,000,000 volts to electrons whirling in its vacuum tube at a dizzy speed.

Attaching License to Dog's Collar



A good way to attach a license to a dog's collar so that it will not become lost, yet is easy to remove, is to use a piece of wire as shown. The wire, copper is best, is bent to a wide U-shape to fit in the holes in

the license tag. Then it is pushed through holes in the collar from the underside and the metal license tag slipped over the projecting ends, which are then bent over and formed into tight loops.

—Wm. E. Davies, Flint, Mich.

Our Ring of Steel

(Continued from page 75)

Panama triangle, but it insures domination of the entire northeastern Pacific. In laying out the defense facilities there the accent has been on bombers because the present war has indicated that within their areas, land-based bombers can decide the outcome of naval battles. Distances grow short across the top of the world and Dutch Harbor is 2,340 miles from Yokohama, 800 miles closer to Japan than is Hawaii. From another Alaskan base it is a 4,875-mile hop to Hamburg.

Panama, the southern corner of the Pacific triangle, was long ago strongly prepared against assault. Now its zone of defense is being extended out into both oceans. Big guns on the hills and in the jungles can outshoot any battleship afloat. Elaborate precautions have been taken to prevent a foreign vessel from scuttling itself in the canal. Special counter-espionage and anti-sabotage measures are being enforced. Visitors who stray into forbidden areas are presumed to be violating the many "restricted zone" signs and are to be fired upon by hidden guards. The Canal is too important to risk chances.

New air bases are under construction on stepping stones to the South Seas, and naval facilities in south Pacific American possessions are being strengthened.

America relies on its fleets to keep invaders away and the development of the offshore bases on both coasts have materially increased the ability of our fleets to win their battles. Bases must be handy to possible scenes of action, otherwise the fighting ships might have nearly all their fuel expended when they entered a fight. Ships, bombers, observation and torpedo planes constantly patrol the bases.

Likewise, the east and west coasts of the continent itself are under protective surveillance. Naval air and surface vessels are keeping up a continuous security patrol. Closer to the beaches, the smaller craft of the inshore patrols are at work. Today no ship can enter an American harbor without permission and even then it is inspected beforehand.

Look in the index to find where to buy articles described in this magazine. Say You Saw It in Popular Mechanics.



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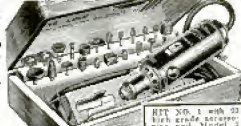
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Super-Speed Bullets

(Continued from page 10)

expanding gas out through the barrel.

Miller's .22 magnum bullet, spitzer pointed and copper jacketed, weighs 40 grains grains and the powder charge behind it weighs 70 grains, as compared to the $2\frac{1}{2}$ -grain powder charge behind an ordinary .22 long rifle pellet. An army bullet weighs 150 grains and is propelled by only 50 grains of powder. The army bullet has a muzzle velocity of 2,700 feet per second and the ultra-high-speed .22 bullet leaves its gun at about twice that speed. This accounts for its flat trajectory which practically eliminates the mathematics of sighting, and for its tremendous killing power. The sudden and intense pressure to which a live target is subjected even when the skin is hardly creased disorganizes nerve centers all over the body, resulting in immediate death.

If super-high velocity is so good, why doesn't the army adopt it and abandon its present infantry cartridge which hasn't been improved since 1906? There are several reasons.

New guns would have to be built to replace the millions of rifles now in service and there is no time at present for such a change-over. Even though our infantryman's gun and cartridges are old-fashioned they are still the best combination now used by any army on earth.

Another objection is that ultra-high velocities are hard on gun barrels. The present army rifle is good for upwards of 5,000 rounds while the barrel of a super-high velocity gun wears out within 1,000 rounds. Present super speeds have been possible only since the development of the new chrome-moly-manganese alloys and after more research with alloys a more enduring barrel material may be found.

But these objections don't apply to special service weapons such as tank, antitank, and antiaircraft guns and there is a rumor that super-high velocities already have been adopted by the Germans for one antitank gun design. Barrels for such guns can be replaced at frequent intervals. The special cartridges would be no more of a supply problem than the special shells that are now required. Since an ultra-high-velocity bullet is both armor-piercing and ex-

(Continued to page 190)

WHAT? NO RACE AT INDIANAPOLIS?



Typ: Mauri Rose and Floyd Davis, who led in famous "Vinny Lane" at 240 m.p.h. in 1934. Rose and his best victory smile. He's a hunter for Buick.

It may be several years before racing is resumed at the most famous speedway in the world. But rapid race fans will never forget the amazing performance, last Memorial Day, of Mauri Rose in Floyd Davis' Buick "Grat-Flux" equipped No. 10. Following Floyd at the 173 mile mark, at 230 miles he was 8th . . . at 300 he was 4th . . . at 405 he was out in front, never to be headed. When you discover that in spite of the terrific pace and heat, Rose used less than a gallon of oil and got almost 12 miles in the hollow of steel, you realize what a great job Buick "Grat-Flux" Piston Rings did. It's the inherent self-sealing and self-lubrication qualities of the "Grat-Flux" process that reduce friction to a fraction . . . eliminate the "run-in" period . . . that are making Buick rings famous on the highway and speedway. Mail the coupon for free folder . . . and your copy of the Handy Handbook.

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Another improvement that custom gunsmiths have made is in reducing the length of a gun without shortening its barrel. The barrel and action are moved back on the wooden stock so that the action is right at the butt of the stock instead of over the trigger, which remains in the usual place. The result is a club-shaped weapon that is about 14 inches shorter than conventional design. Called a butt-action carbine, it has good balance and is as easy or easier than an ordinary gun to aim and shoot. The design is still in a state of flux and additional improvements may be made.

The butt-action carbine owes its development to the automobile. A long-barreled rifle is an awkward weapon to handle in and out of a car and for that matter is unhandy when carried in a saddle holster. The new design is much easier to manipulate in close quarters. Because of this, gunsmiths think that the butt-action eventually will be adopted for parachute troops, motorized troops, and for other groups that must operate in confined spaces.

Another trend in sporting rifles that is expected to be reflected in military weapons is the increased use of telescopic sights. Military sharpshooters have used them for decades and now they seem to be coming in for more general use. The sighting telescope is mounted above and parallel to the gun barrel. For shooting against fixed targets in competition, scopes of up to 25 power are used, which give the shooter the advantage of examining the target practically under a microscope. At 100 yards range the target appears through the scope to be only a few yards away. This power is too extreme for the field, and for hunting and for military use scopes of about four power are preferred.



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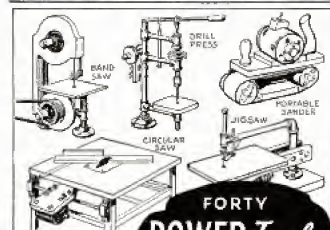
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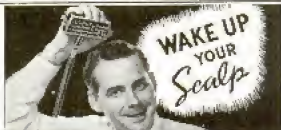
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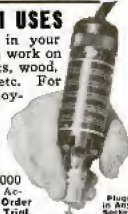


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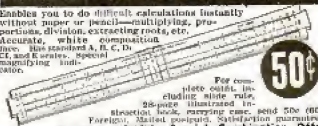


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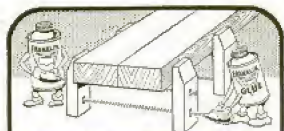
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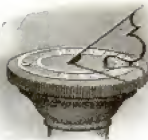


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No obligation to buy. Send no money. See machine on wide-open 10-day Trial. Pay on easiest terms—only 10c a day. You get this genuine late office model L. C. Smith completely reconditioned with all standard improvements—basket shift, standard 34-character, 4-row keyboard, shift lock key, back spacer, 2 color ribbon, automatic ribbon reverse, stencil cutting device, tabulator, etc. Ball bearing throughout—quiet operation. THOUSANDS PAID \$102.50—IT'S YOURS FOR ONLY \$37.85 (CASH PRICE). No risk, money back guarantee.

2 YEAR GUARANTEE

Our 2 year ironclad guarantee is your assurance of satisfaction and long service! Our 30 years of Fair Dealing Backs This Guarantee.

NO EXTRA CHARGE!—14" MODELS

The L. C. Smith with basket shift is the machine used by schools, large corporations, and business houses the country over. A perfect all purpose typewriter for office work, correspondence, manifold work, etc. The wide carriage machine contains all modern improvements same as the regular carriage (illustrated) but it takes paper 14 inches wide and has a writing line of 12 inches. The wide carriage machine is the model you need for making government reports, large office forms, billing, etc. And it can be yours at No Extra Cost for a limited time—only \$37.85 cash—an extremely low price for a wide carriage machine—or you can buy on easy terms of only \$3.00 a month—less than the cost of renting an inferior model!

EXTRA VALUE
ROLL-AWAY SECRETARIAL

TYPEWRITER STAND

For those who have no typewriter stand or handy place to use a typewriter, I make this special offer. This attractive stand that ordinarily sells for \$4.85 can be yours with L. C. Smith for only \$2.50 extra—payable 25c a month. Quality built. Just note all the convenient features. (See coupon.)



Mounted on casters, can be moved by touch of finger.

Big working surface, all metal, compact, strong, quiet, rigid, attractive. Two metal wings, correct working height.

FREE

COMPLETE TOUCH TYPING COURSE

We give FREE with your L. C. Smith a complete 8 lesson Home Study course of Famous Van Sant Touch Typing system. You can now learn typing quickly and easily.

OFFER FOR LIMITED TIME—SEND COUPON TODAY

Accept this wide open offer now! Send no money. Use L. C. Smith for 10 day trial in your home. Return it if you don't think it the greatest value you have ever seen. If you buy, pay on easiest terms—only \$3.00 a month. 2 yr. ironclad guarantee. Avoid disappointment—mail coupon today.

MAIL THIS COUPON

INTERNATIONAL TYPEWRITER EXCHANGE
Dept. 401, 231 W. Monroe St., Chicago, Ill.

Send me L. C. Smith (P. O. B. Chicago) for 10 days' trial. If I keep it I will pay \$3.00 per month until easy term price (\$43.85) is paid. If I am not satisfied I can return it express collect.
☐ 10" carriage
☐ 14" carriage (No Extra Charge)
☐ Check for typewriter stand \$2.50 extra, payable 25c a month. Stand sent on receipt of first payment on L. C. Smith.

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City.....

CAUTION—For Quick Shipment Give Occupation and Reference
OVER 200,000 SATISFIED CUSTOMERS ALL OVER THE WORLD.

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WHAT! A girl training men to fly for Uncle Sam?

THE name is Lennox — Peggy Lennox. She may not look the part of a trainer of fighting men, but—

She is one of the few women pilots qualified to give instruction in the CAA flight training program. And the records show she's doing a man-sized job of it. She's turned out pilots for the Army... for the Navy. Peggy is loyal to both arms of the service. Her only favorite is the favorite in every branch of the service—Camel cigarettes. She says: "It's always Camels with me—they're milder in every way."



FLYING INSTRUCTOR
PEGGY LENNOX SAYS:

"THIS IS THE
CIGARETTE FOR ME.
EXTRA MILD—
AND THERE'S
SOMETHING SO
CHEERING ABOUT
CAMEL'S
**GRAND
FLAVOR"**



Don't let that smile fool you. When this young lady starts talking airplanes — and what it takes to fly 'em — brother, you'd listen, too... Just like these students above.



• "Extra mild," says Peggy Lennox. "Less nicotine in the smoke," adds the student as they talk over Camels in the pilot room above. Yes, there is less nicotine in the smoke of Camels...extra mildness...but that alone doesn't tell you

why, with smokers in the service...in private life, as well...Camels are preferred.

No, there's something more. Call it flavor, call it pleasure, call it what you will, you'll find it only in Camels. You'll like it!

With Instructor Peggy Lennox, it's strictly Camels. "Mildness is a rule with me," she explains. "That means slower-burning Camels. There's less nicotine in the smoke."

L. J. Reynolds Tobacco Company, Winston-Salem, N. C.

The smoke of slower-burning Camels contains

28% LESS NICOTINE

than the average of the 4 other largest-selling cigarettes tested—less than any of them—according to independent scientific tests of the smoke itself!

CAMEL — THE CIGARETTE OF
COSTLIEST TOBACCO



• BY BURNING 25% SLOWER than the average of the 4 other largest-selling brands tested—slower than any of them—Camels also give you a smoking *plus* equal, on the average, to

**5
EXTRA SMOKES
PER PACK!**